



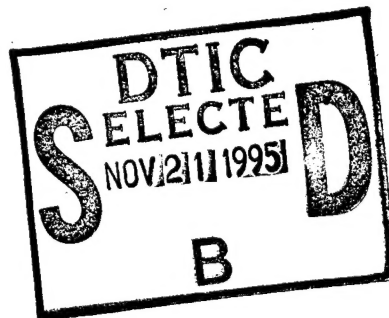
**US Army Corps
of Engineers**

Waterways Experiment
Station

Miscellaneous Paper EL-95-5
September 1995

Assessment of Sea Turtle Abundance in Six South Atlantic U.S. Channels

*by Dena D. Dickerson, Kevin J. Reine,
David A. Nelson, Charles E. Dickerson, Jr.*



Approved For Public Release; Distribution Is Unlimited

19951117 048

DTIC QUALITY INSPECTED 3

Prepared for U.S. Army Engineer Division, South Atlantic
and U.S. Naval Submarine Base, Kings Bay

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products.



PRINTED ON RECYCLED PAPER

Miscellaneous Paper EL-95-5
September 1995

Assessment of Sea Turtle Abundance in Six South Atlantic U.S. Channels

by Dena D. Dickerson, Kevin J. Reine,
David A. Nelson, Charles E. Dickerson, Jr.

U.S. Army Corps of Engineers
Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Final report

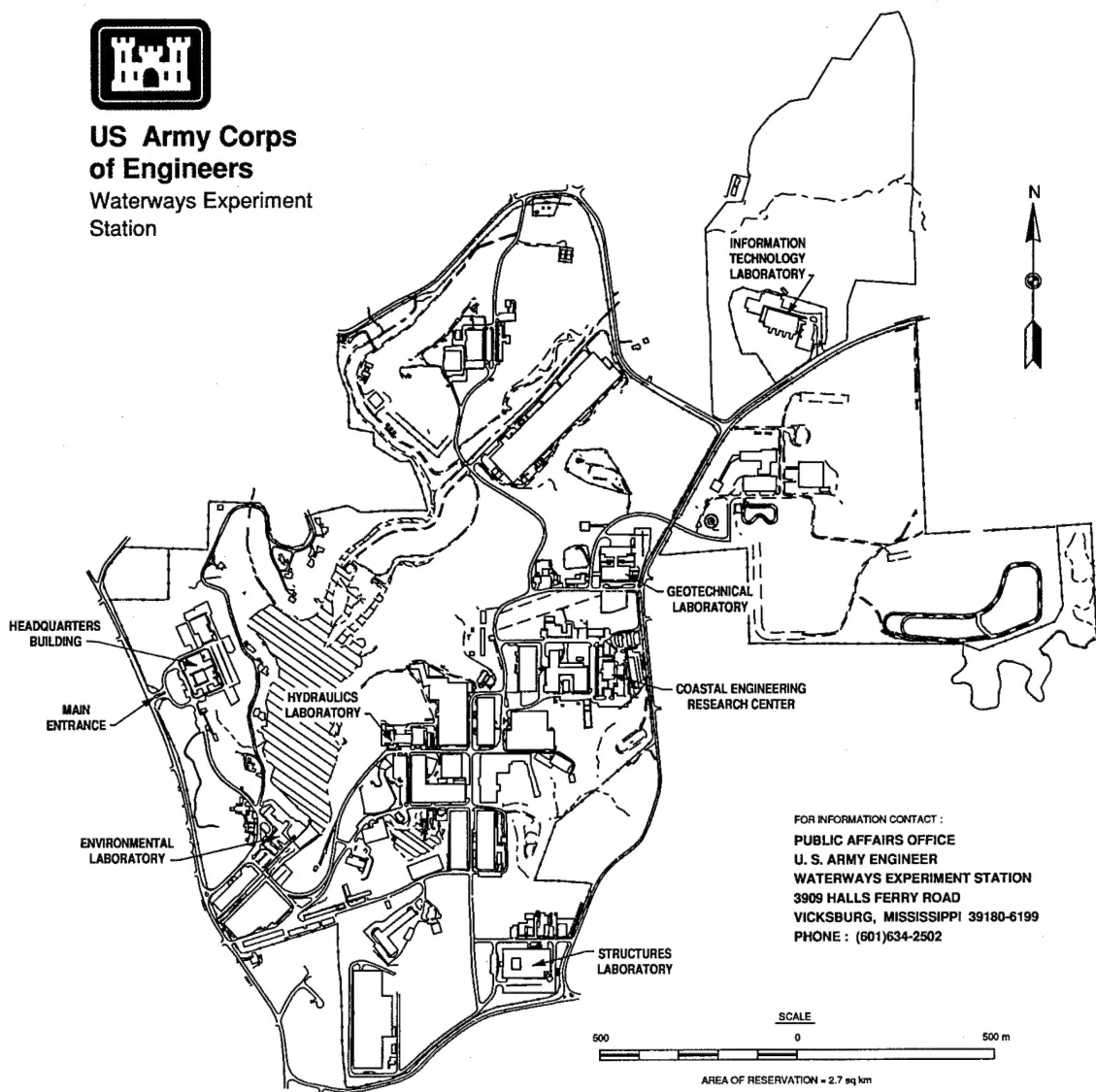
Approved for public release; distribution is unlimited

Prepared for U.S. Army Engineer Division, South Atlantic
Atlanta, GA 30355-6801

and U.S. Naval Submarine Base
Kings Bay, GA 31558



**US Army Corps
of Engineers**
Waterways Experiment
Station



FOR INFORMATION CONTACT :
PUBLIC AFFAIRS OFFICE
U. S. ARMY ENGINEER
WATERWAYS EXPERIMENT STATION
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199
PHONE : (601)634-2502

Waterways Experiment Station Cataloging-in-Publication Data

Assessment of sea turtle abundance in six south Atlantic U.S. channels / by Dena D. Dickerson ... [et al.] ; prepared for U.S. Army Engineer Division, South Atlantic and U.S. Naval Submarine Base.

134 p. : ill. ; 28 cm. -- (Miscellaneous paper ; EL-95-5)

Includes bibliographic references.

1. Sea turtles -- Protection. 2. Dredging -- Environmental aspects. 3. Endangered species -- Protection. I. Dickerson, Dena D. II. United States. Army. Corps of Engineers. South Atlantic Division. III. U.S. Army Engineer Waterways Experiment Station. IV. Environmental Laboratory (U.S. Army Engineer Waterways Experiment Station) V. Naval Submarine Base (Kings Bay, Ga.) VI. Series: Miscellaneous paper (U.S. Army Engineer Waterways Experiment Station) ; EL-95-5.

TA7 W34m no.EL-95-5

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

Contents

Preface	vi
Acknowledgments	vii
Conversion Factors, Non-SI to SI Units of Measurement	ix
1—Introduction	1
2—Study Areas	6
Morehead City Harbor Entrance Channel, North Carolina	6
Charleston Harbor Entrance Channel, South Carolina	6
Savannah Harbor Entrance Channel, Georgia	7
Brunswick Harbor Entrance Channel, Georgia	7
Fernandina Harbor St. Marys River Entrance Channel, Florida	7
Canaveral Harbor Entrance Channel, Florida	8
3—Methods	9
Trawler and Net Design	9
Sampling Protocol	9
Turtle Handling and Measurements	10
Environmental Parameters	12
Data Analyses	12
Permits	13
4—Results	14
Trawl Effort	14
Species Composition, Size Frequency, Relative Abundance	15
Spatial (Station) Distribution	16
Seasonal Distribution	18
Environmental Parameters	20
Relocation	22
Recaptures	27
5—Discussion	29
Species Composition, Size Frequency, Relative Abundance	29
Seasonal Distribution	31
Spatial (Station) Distribution	32
Relocation	32

Recaptures	33
Water Temperature and Relative Abundance	34
6—Summary	37
7—Conclusions and Recommendations	39
References	40
Tables 1-34	
Appendix A: Turtle Trawl Net Specifications and Data Sheets	A1
Appendix B: Trawling Protocol Meeting Participants	B1
Appendix C: Summary of Sea Turtle Captures	C1
Appendix D: Summary of Sea Turtle Recaptures	D1
SF 298	

List of Figures

Figure 1. Southeastern United States hopper dredged channels	2
Figure 2. Description of six South Atlantic hopper dredged channels surveyed	5
Figure 3. General external morphology of sea turtles and measurements	11
Figure 4. Distribution of SCL for loggerheads captured from June 1991 through March 1993	16
Figure 5. Distribution of juveniles and adult loggerheads captured from June 1991 through March 1993	17
Figure 6. Distribution of monthly CPUE (turtles/hour) (loggerheads only) from June 1991 through March 1993	18
Figure 7. CPUE rates (turtles/hour) by sampling stations	19
Figure 8. CPUE rates (turtles/hour) by seasons	20
Figure 9. Percent composition of loggerhead turtles, in three sex categories (adult male, adult female, and juveniles)	21
Figure 10. CPUE rates (turtles/hour) and distribution of turtles captured (all species combined) referenced to mean bottom water temperature (°C)	23
Figure 11. Monthly CPUE rates (turtles/hour) (all species combined) and mean bottom water temperature (°C) for Charleston Harbor entrance channel, South Carolina, and Savannah Harbor ocean bar channel, Georgia	24

Figure 12.	Monthly CPUE rates (turtles/hour) (all species combined) and mean bottom water temperature (°C) for Fernandina Harbor St. Marys River entrance channel, Florida, and Brunswick Harbor ocean bar channel, Georgia	25
Figure 13.	Monthly CPUE rates (turtles/hour) (all species combined) and mean bottom water temperature (°C) for Canaveral Harbor entrance channel, Florida, and Morehead City Harbor entrance channel, North Carolina	26

Preface

This work was performed by the Environmental Laboratory (EL) of the U.S. Army Engineer Waterways Experiment Station (WES) in response to the request and sponsorship from the U.S. Army Engineer Division, South Atlantic, and the U.S. Naval Submarine Base, Kings Bay, Georgia. The project was managed by Mr. Clark McNair, Coastal Engineering Research Center, WES, with assistance from Dr. Lyndell Hales.

Data were collected by WES and Drs. Alan B. Bolten (University of Florida, Gainesville), James I. Richardson (University of Georgia Institute of Ecology, Athens), and William Schaaf (retired, National Marine Fisheries Service). Trawling research vessels were provided under contract to WES by Captain Mike Cox (*Mona Lisa*), Captain Eddie Chadwick (*Mickey Anne*), Captain Kenneth Lewis (*Mary Ann*), University of Georgia Marine Extension Service (*R/V Georgia Bulldog*), and Captain Joe Webster (*Dammit*).

The report was prepared by Ms. Dena D. Dickerson, Messrs. Kevin J. Reine, David A. Nelson, and Charles E. Dickerson, Jr., of the Ecological Research Division (ERD), EL, under the direct supervision of Dr. Douglas G. Clarke, Acting Chief, Coastal Ecology Branch, and under the general supervision of Dr. Conrad Kirby, Chief, ERD, and Dr. John W. Keeley, Director, EL.

At the time of publication of this report, Director of WES was Dr. Robert W. Whalin. Commander was COL Bruce K. Howard, EN.

This report should be cited as follows:

Dickerson, D. D., Reine, K. J., Nelson, D. A., and Dickerson, C. E., Jr. (1995). "Assessment of sea turtle abundance in six South Atlantic U.S. channels," Miscellaneous Paper EL-95-5, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products.

Acknowledgments

The EL would like to thank the U.S. Army Corps of Engineers South Atlantic Division and Charleston, Jacksonville, Mobile, Savannah, and Wilmington Districts, and the U.S. Naval Submarine Base, Kings Bay, particularly Rudy Nyc, Tucker Russell, Jim Woody, Liz Manners, Mike Dupes, Doug Nester, Steve Calvert, David Crosby, Bill Adams, Trudy Wilder, Jim More, Paul Schoenfield, and Stephanie Bolton for their support during this project.

Also thanks go to Terry Henwood, Margo Bohan, and Phil Williams of the National Marine Fisheries Service, Mike Harris and Charles Maley of the Georgia Department of Natural Resources, Barbara Schroeder of the Florida Department of Natural Resources, Tom Henson of the North Carolina Wildlife Resources Commission, Sally Murphy and Tom Murphy of the South Carolina Wildlife and Marine Resources, and participants of the USACE Sea Turtle Trawling Survey Protocol Committee (Appendix B) for their technical advice and suggestions.

Special thanks go to Captains Joe Webster and James Webster and crew members Jody Terry and Jerry Colton of the *Dammit*; Captains Lindsey Parker and Marty Higgins and crew members Paul Daniels, Tom "Frito" Sherling, Nick Pfeiffer, Kevin Courtney, Jim Dickey, Bill Bennett, Craig Jones, Richard Puterbaugh, Nolton Carter, John Vosburg, Rusty Flournoy, John Lee, and Kevin Crummey of the *R/V Georgia Bulldog*; Captain Kenneth Lewis, Sr., and crew members Kenneth Lewis, Jr., Carroll Lewis, Robert Norris, Bobby Guthrie, Hugh Brewer III, Joe Nelson, Frank Gaskill, Jr., and Kevin Hardy of the *Mary Ann*; Captain Eddie Chadwick and crew members Mickey Ann Chadwick, William Leonard, and Steven Brown of the *Mickey Anne*; and Captain Mike Cox and crew members Marion Gill and Marion Lasamme of the *Mona Lisa*. The dedication and exceptional skills of these captains and crew members facilitated the success of this project.

Additional technical and equipment assistance was provided by Dave Herrington and staff at the University of Georgia Marine Extension Service. Additional field assistance was provided by William Schaaf, Scott Atkinson, Ray Carthy, Drew Crain, Scott Edwards, Sandra Encalada, Michael Guilbeaux, Michael Moody, Jerry Moss, Laura Robertson, Jeff Schmid, and Peter Vila.

Data management assistance was provided by Randall Henderson, George Moncrief, Jerry Moss, Joyce Richards, and Craig Theriot. Additional field assistance was contracted through and coordinated by Alan Bolton of the University of Florida and Jim Richardson of the University of Georgia. Additional data management and statistical analysis assistance was provided by George Bratton of the University of Central Arkansas.

Conversion Factors, Non-SI to SI Units of Measurement

Non-SI units of measurement used in this report can be converted to SI units as follows:

Multiply	By	To Obtain
cubic yards	0.7645549	cubic meters
feet	0.3048	meters
knots	0.5144444	meters per second
miles (U.S. statute)	1.609347	kilometers
miles (nautical)	1.852	kilometers

1 Introduction

The U.S. Army Corps of Engineers (USACE) is responsible for maintaining the navigability of entrance channels to harbors, seaports, and some military facilities along the southeastern U.S. coast (Figure 1). Most of these channels are inhabited for at least part of the year by sea turtles classified as federally threatened or endangered; however, the highest concentrations of sea turtles are found along the Atlantic beaches of central and southern Florida (National Research Council 1990). The relative abundance and activities of sea turtles associated with ship channel habitats are virtually unknown. Sea turtles are listed as threatened or endangered species because their population levels have declined severely throughout the world over the last 20 to 30 years (National Research Council 1990). Their population decline is the result of numerous factors such as incidental capture during fishing, habitat destruction, and uncontrolled slaughter for leather, jewelry, and meat. Documented sea turtle mortalities due to entrainment during hopper dredging operations have been reported since 1980 from some South Atlantic channels (Joyce 1982, Dickerson et al. 1991). A Sea Turtle/Dredging Task Force was formally established by the U.S. Army Engineer Jacksonville District in May 1981 to address the issue of dredging impacts on sea turtles (Studt 1987). Although a total of five sea turtle species occur along the southeastern U.S., the National Marine Fisheries Service (NMFS) has determined that loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and Kemp's ridley (*Lepidochelys kemp*i) sea turtles are the species most at risk from hopper dredging (NMFS Regional Biological Opinion 1991).

The Endangered Species Observer Program was established in 1980 and evolved through consultation between the NMFS and USACE, in accordance with the Endangered Species Act. Endangered species observers have been employed during hopper dredging projects whenever biological data suggest potential negative impacts on sea turtles. Observer records document the intake of turtles or turtle parts through the vessel's dragheads and subsequently into the ship's hopper. Sampling for entrained turtles is accomplished through observation and inspection of the hopper and the dragheads and screening of dredged material from the intake structures or hopper overflow. Recovery, accurate identification, and documentation of sea turtle parts are vital to the evaluation of dredging impacts, success of conservation management procedures, and the development of alternative dredging equipment.

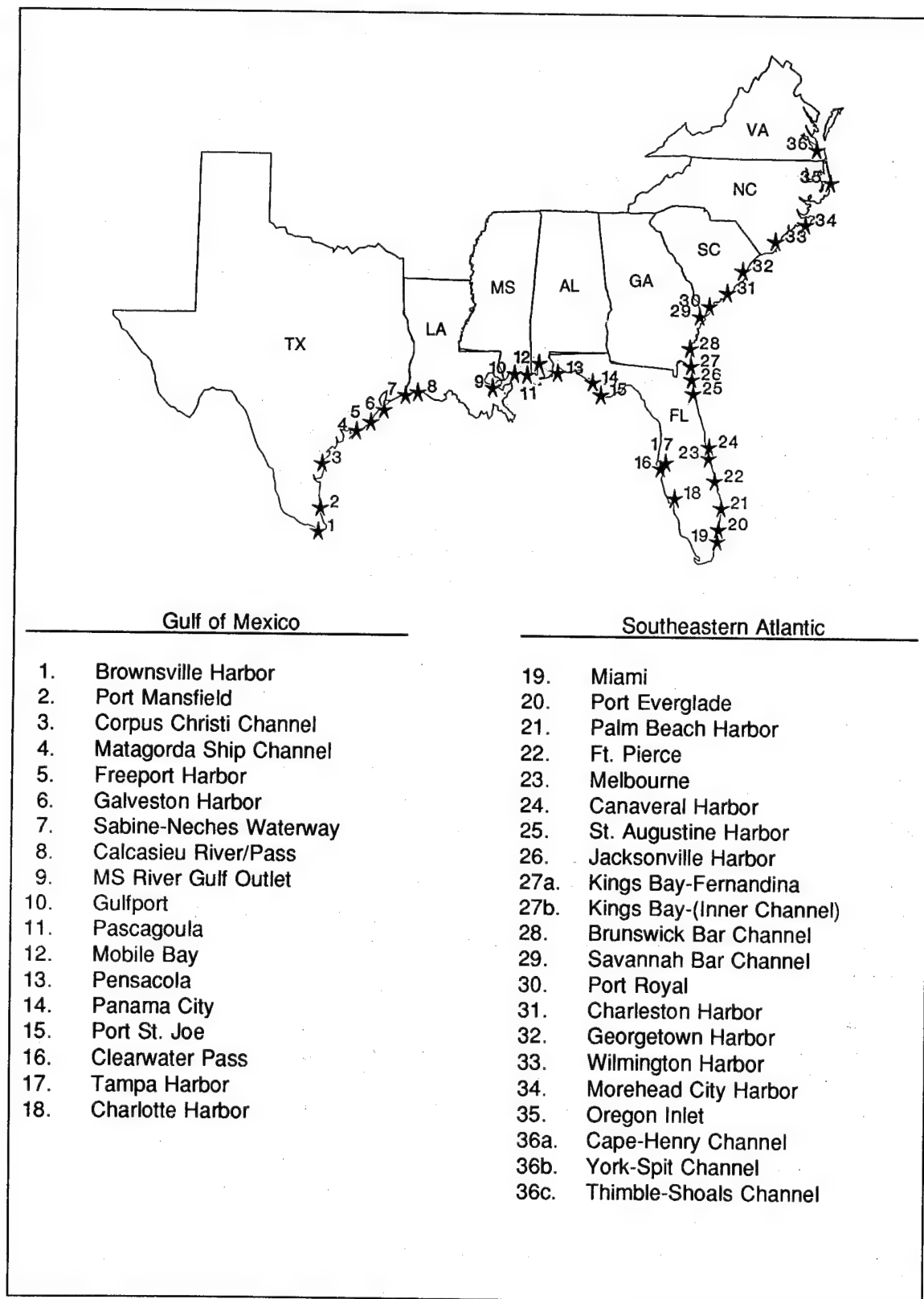


Figure 1. Southeastern United States hopper dredged channels

A significant problem in interpreting and analyzing observer records is variation in sampling efficiency and observer monitoring (Dickerson et al. 1991). Guidelines set forth in the NMFS Regional Biological Opinion (1991) addressed these inconsistencies. The Endangered Species Observer Program is reviewed in Dickerson et al. (1991 and 1993).

Summaries of both killed and living/injured sea turtle incidents from all available records are given in Tables 1 and 2 (Joyce 1982; National Research Council 1990; Dickerson et al. 1991; unpublished data from dredging logs and endangered species observer reports to USACE). During dredging along the South Atlantic U.S. coast from 1980 to April 1994, 236 incidents (dead and injured) involving three species of sea turtles (loggerhead, green, and Kemp's ridley) were reported. Entrainments of sea turtles during dredging operations were documented only from hopper dredges and primarily in Canaveral Harbor entrance channel, Florida; Fernandina Harbor St. Marys River entrance channel (Kings Bay), Florida; Brunswick Harbor ocean bar channel, Georgia; and Savannah Harbor ocean bar channel, Georgia. A low number of incidents were also documented at Charleston Harbor entrance channel, South Carolina; Port Royal Harbor, South Carolina; Ft. Pierce Inlet, Florida; and Morehead City Harbor entrance channel, North Carolina. The lack of reported impacts on turtles in other hopper dredged channels and on other types of dredges may be a result of reduced turtle occurrences in the channels during the time of dredging, reduced potential of turtle impingement by the dredge, or a lack of monitoring for documentation of incidents during dredging.

A significant reduction in sea turtle entrainments have been documented since the first reported incidents in 1980. This may have resulted from modifications in management and operational practices or may be a reflection of seasonal occurrences and annual fluctuations in sea turtle populations. The National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles in 1988 examined potential dredging and management alternatives, as well as identified biological studies and information gaps (Dickerson and Nelson 1990). A number of management alternatives are currently being implemented to minimize impacts to sea turtles including seasonal restrictions, rescue and relocation operations, and modified dredging equipment (Nelson et al. 1989; Dickerson, Nelson, and Banks 1990). The information gathered by the Endangered Species Observer Program was used as the foundation for management decisions and recommendations. Consistent and thorough documentation of sea turtle incidents, as well as an understanding of sea turtle utilization of dredged channels, are necessary for the development of better management strategies.

Since the first reported incidents of sea turtle deaths from dredging operations, resource managers have recognized the need for more complete sea turtle life history information (Dickerson and Nelson 1990). The majority of information available on these animals concerns the small portion of their life spent on the beach during nesting (National Research Council 1990). Spatial and temporal distributions have historically been based on nesting distributions, stranding reports, and pelagic aerial surveys. There is very little information

available pertaining to their specific use of channels. The large number of sea turtle mortalities in 1980 at Canaveral Harbor prompted trawling surveys to assess sea turtle abundance in some South Atlantic channels during 1981-1982. Trawling surveys have been periodically conducted in Canaveral Harbor since the late 1970's (Butler, Nelson, and Henwood 1987; Henwood 1987; Henwood and Ogren 1987; Bolten and Bjorndal 1988, 1991).

Without more information on sea turtle utilization of these channels, it is difficult to develop sound, long-term management and conservation plans. To develop management strategies, a multifaceted sea turtle research program was initiated in 1991 along the South Atlantic coast by the USACE (Dickerson et al. 1993). These studies have included both biological and engineering research approaches and cooperative participation between the academic community and state and Federal agencies.

As part of the biological studies, monthly surveys were conducted in six channels along the southeastern Atlantic U.S. coast (Figure 2). The six channels selected were: Canaveral Harbor entrance channel, Florida; Fernandina Harbor St. Marys River entrance channel (Kings Bay), Florida; Brunswick Harbor ocean bar channel, Georgia; Savannah Harbor ocean bar channel, Georgia; Charleston Harbor entrance channel, South Carolina; and Morehead City Harbor entrance channel, North Carolina. Although surveys were conducted only in the outer portion of each harbor project, this report refers to each of these channels as "harbor" for clarity and consistency. This report documents the results of trawling surveys performed from June 1991 to March 1993. The results of relocation efforts conducted during this time are also included. The objectives of these surveys were to evaluate species composition, population structure, and spatial and temporal (seasonal) distributions. This information may be used to help define and refine seasonal windows when sea turtles are least likely to be present and hopper dredging may occur.

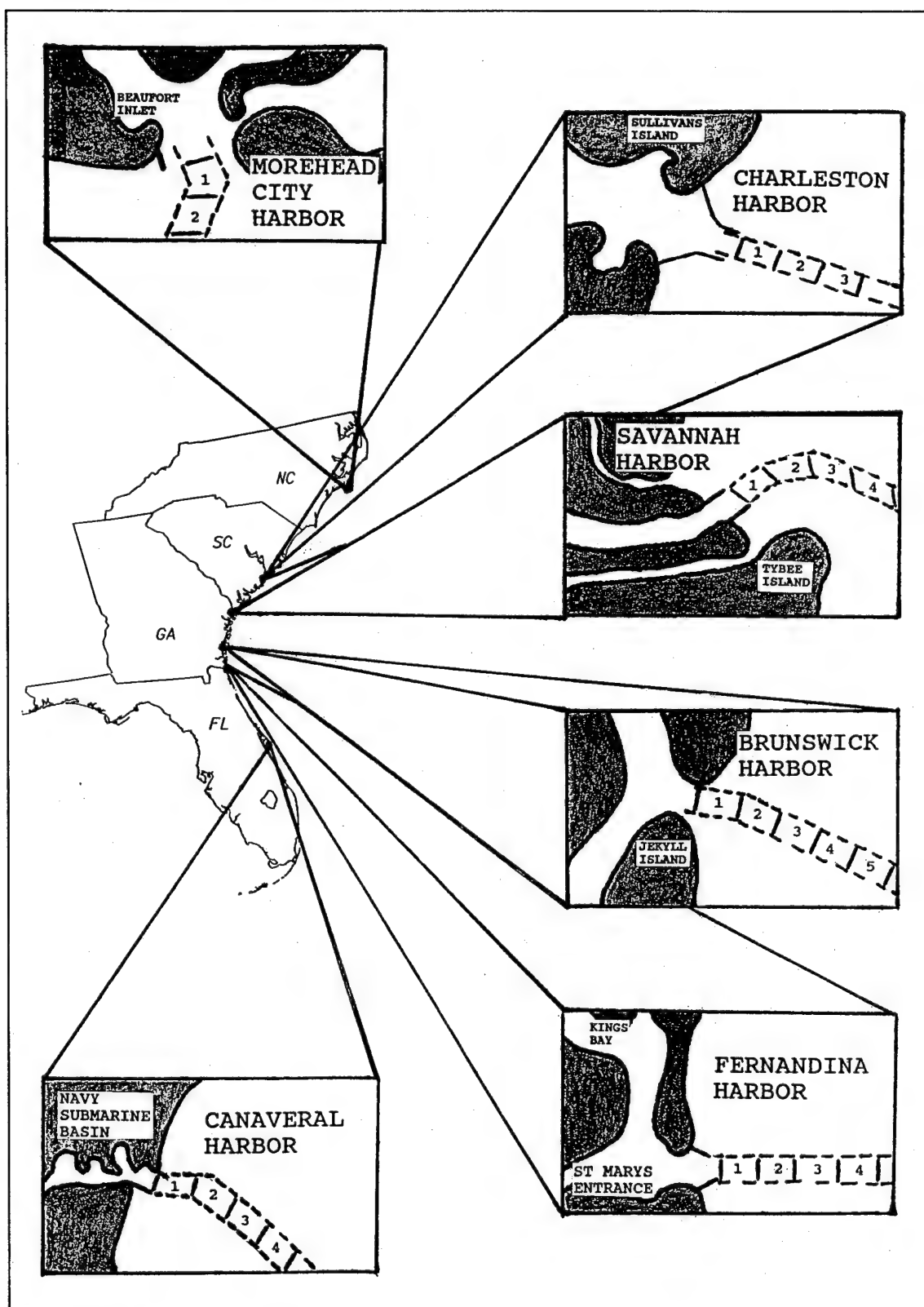


Figure 2. Description of six South Atlantic hopper dredged channels surveyed

2 Study Areas

Morehead City Harbor Entrance Channel, North Carolina

Morehead City Harbor ($34^{\circ} 43'N$, $76^{\circ} 43'W$) is on a peninsula extending easterly from the North Carolina mainland between Bogue Sound and Calico Creek. Bogue Sound is a shallow body of water extending 22 miles¹ westward along the North Carolina coast from Beaufort Inlet to Bogue Inlet. Beaufort Inlet is about midway between Cape Hatteras and Cape Fear. The deepwater dredged portion of Morehead City Harbor entrance channel from the Atlantic Ocean to the port is through Beaufort Inlet between Bogue and Shackleford Banks (Figure 2).

The dredged section of Morehead City Harbor entrance channel is 2.4 nautical miles (nm) (4.4 km) in length, 140 m in width, and maintained at a depth of 14.3 m (47 ft) below mean low water. The 3.24-nm (6-km) portion of the channel surveyed for sea turtles was from inshore Buoy 10 to the off-shore sea buoy (Table 3).

Charleston Harbor Entrance Channel, South Carolina

Charleston Harbor ($35^{\circ} 15'N$, $80^{\circ} 50'W$) is located midway along the South Carolina coastline at the junction of the Ashley, Cooper, and Wando Rivers. Freshwater discharge into Charleston Harbor is primarily from the Cooper River with small amounts being contributed by the Ashley and Wando Rivers. The harbor is bordered on the north by Sullivans Island and Mt. Pleasant, and on the south by Morris and James Islands (Figure 2). The city of Charleston is located at the western end of the harbor between the Ashley and Cooper Rivers.

¹ A table of factors for converting non-SI to SI units of measurement is presented on page ix.

The dredged section of Charleston Harbor including the Cooper River is 22.9 nm (42.4 km) long, 150 to 210 m wide, and maintained at a depth of 13.4 m (44 ft) below mean low water. The portion of the channel surveyed for sea turtles began seaward of the harbor entrance jetties to 4.86 nm (9 km) offshore (Table 3).

Savannah Harbor Entrance Channel, Georgia

Savannah Harbor (32° 02'N, 80° 50'W) is located at the mouth of the Savannah River. The channel is bordered by Turtle Island to the north and Tybee Island to the south (Figure 2).

The dredged section of Savannah Harbor entrance channel is 6.6 nm (12.2 km) in length, 180 m in width, and maintained at a depth of 12.8 m (42 ft) below mean low water. The portion of the channel surveyed for sea turtles was from the harbor jetties to 6.48 nm (12 km) offshore (Table 3).

Brunswick Harbor Entrance Channel, Georgia

Brunswick Harbor (31° 07'N, 81° 25'W) includes St. Simons Sound and the tidally influenced portion of Brunswick and Back Rivers. The channel passes between St. Simons Island to the north and Jekyll Island to the south (Figure 2).

The dredged section of Brunswick Harbor entrance channel is 5 nm (9.3 km) in length, 150 m in width, and maintained at a depth of 9.8 m (32 ft) below mean low water. The portion of the channel surveyed for sea turtles was from inshore Buoy 19 to 8.1 nm (15 km) offshore (Table 3).

Fernandina Harbor St. Marys River Entrance Channel, Florida

The entrance channel to Fernandina Harbor (30° 42'N, 81° 28'W) forms the boundary between Georgia and Florida. The channel is bordered by Cumberland Island to the north and Amelia Island to the south. The St. Marys River flows into the inlet (Figure 2). Fernandina Harbor was constructed in 1987 to support the U.S. Naval Submarine Base at Kings Bay, Georgia.

The dredged section of Fernandina Harbor is 8.3 nm (15.4 km) in length, 150 m in width, and maintained at a depth of 14 m (46 ft) below mean low water. The portion of the channel surveyed for sea turtles was from the harbor jetties to 6.48 nm (12 km) offshore of Buoys 7 and 8 (Table 3).

Canaveral Harbor Entrance Channel, Florida

Canaveral Harbor (28° 25'N, 80° 35'W) is located directly south of the John F. Kennedy Space Center, approximately 7 nm (12.9 km) southwest of Cape Canaveral. The deepwater entrance portion of the channel connects on the western side with the Canaveral Barge Canal which continues through a lock, across Banana River, cutting through Merritt Island to connect with Indian River and the Atlantic Intracoastal Waterway. Canaveral Harbor services both commercial and military shipping traffic (Figure 2).

The dredged section of Canaveral Harbor is 5.7 nm (10.6 km) in length, 120 m in width, and maintained at a depth of 13.4 m (44 ft) below mean low water. The portion of the channel surveyed for sea turtles was from the harbor jetties to 6.48 nm (12 km) offshore (Table 3).

3 Methods

Trawler and Net Design

Channel bottom trawling was determined to be the best method available to assess sea turtle occurrences in the portion of the channel most often maintained by hopper dredging. This method allows for the collection of detailed data including species identification, morphometric measurements, and blood chemistry, and also permits tagging of each animal.

Five research trawling vessels were used to capture turtles during the monthly surveys. The vessels were between 22 and 26 m long. Each vessel was doubled-rigged with two 18-m nets constructed from 20-cm mesh (stretch) (see Appendix A for net specifications). The relatively large mesh was used to reduce drag from the net and to reduce bycatch. The opening of each net had an estimated width of 12 m and a height of 3 m when towed. The total estimated trawl path sampling width was 24 m. The nets were towed in close contact with the channel bottom.

Sampling Protocol

Trawling dates and survey objectives are listed in Table 4. The primary objective was to survey the channel for sea turtle abundance. Some surveys were conducted immediately prior to or during dredging activity in the channel. As required by the NMFS Regional Biological Opinion (1991), pre-dredge surveys were conducted to assess sea turtle abundance, as well as to determine the potential for negative impacts to sea turtles from the dredging activity. Surveys conducted during or immediately prior to dredging activities were used to temporarily relocate turtles from the dredging area, as well as to determine relative abundance.

Two approaches to the bottom trawling survey design were used (Table 4). The first approach was to standardize the trawl time without regard for trawl distance or tidal flow. During the June 1991 surveys, the maximum trawl time allowed by NMFS to prevent potential turtle drownings was 45 min. This maximum trawl time was later reduced to 30 min. This standardized time protocol maximized the time the nets were towed; however, variations in

sampling effort may have been introduced with differences in trawl distance and tidal flow.

Based on recommendations from participants of the February 1992 Sea Turtle Technical Workshop (Appendix B), sampling protocol was changed in March 1992 to a standardized trawl distance (1.08 nm, 2 km) rather than time (30 min). Using the standardized trawl distance protocol, individual tows also maintained a trawling time of less than 30 min. Survey trawls were also conducted in the direction of the tidal flow. This protocol allowed for definition of sampling stations and more rigorous quantitative comparisons of sampling effort. Net dimensions and length of sampling stations were also consistent for each sampling effort. Although trawling speed was maintained at a rate of approximately 2.5-3.0 knots, speed was adjusted for the varying tidal flows to maintain steerage of the vessel and proper net deployment. Trawl speed was recorded at the midtrawl point for each tow.

The number of stations and trawls per station for each channel are listed in Table 5. Sampling stations were designated using the standardized distance protocol. (Sampling stations were not used in Brunswick Harbor until the pre-dredge survey in December 1992.) Each channel length was divided into 1.62-nm (3-km) sampling stations (Table 3). Only the central 1.08 nm (2 km) of each 1.62-nm station was sampled to avoid overlap and station "edge effect." The number of trawls per sampling station was determined by dividing the channel width by the estimated total sampling width of the nets (24 m). Each station was sampled 6 to 10 times during a monthly survey depending on the total channel width. Occasionally, the number of trawls differed due to weather conditions or net problems. A requirement was established that both nets had to be functional with no net or equipment damage for a successful trawl. Positions at the beginning and end of each trawl were determined from Loran-C and verified with GPS positioning equipment.

Turtle Handling and Measurements

All turtles caught were identified, measured, tagged, and released into the channel. Turtles were released at their approximate point of capture and returned to the water as soon as possible after capture (from 0.25 to 6 hr). Turtles captured during relocation efforts were released approximately 6 to 12 nm out of the channel. Turtles were kept wet at all times and out of hot and cold temperature extremes while on deck. As a minimum, the following measurements were taken according to the protocol detailed in Pritchard et al. (1983) (Figure 3): maximum straight carapace length (SCL) (nuchal notch to posterior marginal tip), curved carapace length (CCL) (nuchal notch to posterior marginal notch), maximum straight carapace width (SCW), straight plastron length (SPL), maximum head width (HW), tail length (TL) (posterior plastron tip to tip of tail), and weight.

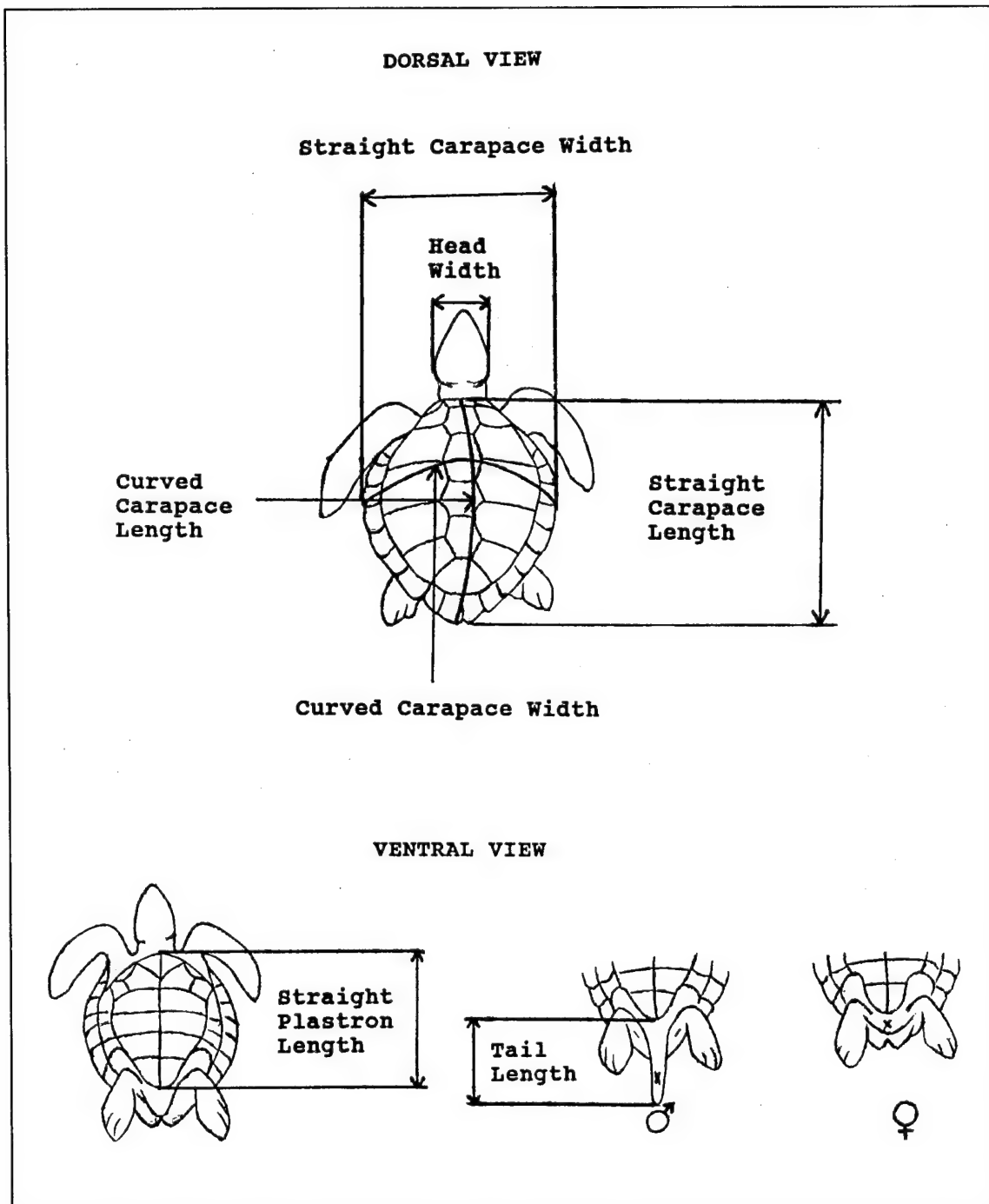


Figure 3. General external morphology of sea turtles and measurements

Turtles were tagged with NMFS #681 inconel tags in each of the front flippers. In addition, a Trovan Passive Integrated Transponder (PIT) was inserted subcutaneously in the wrist of the right front flipper during surveys conducted at Fernandina, Savannah, Charleston, and Brunswick Harbors beginning on 15 June 1992, 10 October 1992, 8 October 1992, and 3 April 1993, respectively. Photographs were taken of each turtle with a card identifying the tag numbers, date, and location captured.

Environmental Parameters

Surface water temperatures were taken from the vessel temperature probe and recorded during each trawl. Water temperatures were also taken with a YSI (Yellow Springs Instruments) temperature probe and hand-held thermometer. Air temperature, barometric pressure, wind velocity and direction, sea-state wave height, and precipitation were obtained from vessel instruments and the local weather service. Tidal stage was recorded for each trawl. Channel depth was also recorded at the beginning and ending of each trawl.

Data Analyses

Results and analyses are presented for all sampling efforts from June 1991 through March 1993 by both sampling protocols, although discussions focus on March 1992 through March 1993. A variety of descriptive data methods and inferential tools (one sample and two-way chi-square) were used when appropriate (Ott 1988). The chi-square goodness-of-fit test was used to verify that towing distances were comparable for all sampling efforts while the standard chi-square test for two-way tables was used to test station preference within channels. Alpha was equal to 0.05 for all analyses except when stated otherwise.

Catch per unit of effort (CPUE) was determined by the USACE Sea Turtle Trawling Survey Protocol Committee (Appendix B) to be best for comparing sea turtle abundances within and between channels. CPUE indices were calculated as number of turtles captured per trawl distance (nm), trawl time (hour), as well as per number of trawls pulled. CPUE calculations include all species captured unless otherwise stated.

In order to assess differences in monthly or seasonal abundance between adult and juvenile loggerhead turtles, those turtles less than 82.5 cm SCL were classified as juveniles while those larger were classified as adults (Witherington 1986; Henwood 1987). Other species captured were not analyzed by size-class.

Permits

All work was conducted under National Marine Fisheries Service scientific collecting permit number 777 and Georgia Department of Natural Resources scientific collecting permit numbers 29-000100 and 29-000015, South Carolina permit number 100-92, North Carolina Wildlife Resources Commission permit number 93 ST 04, and Florida Department of Natural Resources permit number TP 070. Work conducted at Canaveral Harbor by the University of Florida was under National Marine Fisheries Service permit number 664 and Florida Department of Natural Resources permit number TP 016.

4 Results

Trawl Effort

The total number of paired trawls for each channel are listed in Table 6 for each month from June 1991 through March 1993. Mean trawl distance was 1.095 nm (SD 0.0588, $n = 54$) during the 13 sampling months using the standardized distance protocol from March 1992 through March 1993 (Table 7). There was no significant difference in total distance trawled by month among sampling efforts using the standardized distance protocol ($df = 53$, chi-square = 47.8). There was a significant difference in total distance trawled among the sampling efforts from June 1991 through March 1993 using both trawling protocols ($df = 76$, chi-square = 6769.2, $P < 0.001$); therefore, caution should be used when comparing these two sampling periods. The monthly total distance trawled for each channel is given in Table 8.

Trawl time for individual tows during the June 1991 sampling was ≤ 45 min; however, to ensure safety for the turtles, this was reduced to ≤ 30 min for subsequent sampling efforts. Monthly mean trawl time was 29.6 min (SD 0.8349, $n = 20$) for the sampling efforts between August 1991 and April 1992 using the standardized time protocol (Table 9). Trawls conducted between March 1992 and March 1993 using the standardized distance protocol maintained a trawl time of ≤ 30 min with a monthly mean of 22.3 min (SD 3.756, $n = 54$). The combined efforts resulted in a total number of survey hours of 122.3 (Canaveral), 233.1 (Fernandina), 327.1 (Brunswick), 363.5 (Savannah), 227.7 (Charleston), and 118.4 (Morehead City) (Table 10).

Numbers of turtles captured by the port and starboard nets are presented by channel in Table 11. Each net caught 50% (335) of the total 670 turtles captured for all channels surveyed. Since there was no difference in number of turtles captured by either net, data from both nets were pooled.

Throughout the survey period with both sampling protocols, 41.2% of the turtles were captured at ebb tide, 42.2% at flood tide, and 16.6% at slack tide (30 min before and after either high or low tide) (Table 12). Since ebb and flood stages make up the vast majority of the day, the number of trawls taken in these tidal stages greatly exceeds the numbers taken at slack tide. There was no significant difference in numbers of turtles captured between ebb and

flood tidal stages for each channel ($df = 4$, two-way chi-square = 5.53). Tidal flow and currents are weak in Canaveral Harbor; therefore, these data were not included. Note that according to sampling protocols, those trawls conducted by the standardized distance protocol were done in the direction with the tide, whereas those conducted by the standardized time protocol were done both with and against the tide.

Trawl speeds during sampling efforts with a standardized time protocol ranged from 1.1 to 7.9 knots with a mean of 3.2 knots. Mean trawl speed was 2.8 knots (range 1.4 to 4.8 knots) for sampling efforts with a standardized distance protocol.

Species Composition, Size Frequency, Relative Abundance

A total of 670 sea turtles were captured including 645 loggerheads (96.25%), 20 Kemp's ridleys (3%), and 5 green turtles (0.75%) (Table 13). Loggerheads consistently dominated species composition for all six channels. Throughout the study period, more Kemp's ridleys were captured at Fernandina and Brunswick than any other channel. Because of the extremely low sample size during these surveys, few conclusions can be made on the occurrence or relative abundance of Kemp's ridleys or green turtles. Tables 14 through 19 show the monthly distribution of turtles captured by channel and species. Appendix C gives listings of all turtles captured by channel, date, and external flipper tag numbers.

The maximum straight carapace length (SCL) of loggerheads captured by channel and month is presented in Tables 20 through 25 and Figure 4. Only 118 of the 645 loggerheads (18.3%) were classified as adults (≥ 82.5 cm) and 519 loggerheads (80.5%) as juveniles. Seventy-one percent of all captured adults were from Canaveral Harbor. Canaveral Harbor also had the largest occurrence of adult size-class loggerheads with a total of 85 (49.4%) of the 172 loggerheads captured (Figure 5). Measurements were not recorded for 13 individuals; however, notes indicate these were juveniles. Despite considerable variation in SCL size frequencies (40.2 to 112.0 cm) very few turtles over 80 cm or under 50 cm (SCL) were captured in the five channels north of Canaveral Harbor (Figure 4 and Table 20). The majority of turtles captured in these channels were considered juveniles ($SCL < 82.5$ cm) with most being in the 50- to 70-cm size range (Figure 5).

The 20 Kemp's ridley turtles captured had SCL measurements ranging from 30.8 to 62.0 cm. The only adult Kemp's ridley captured ($SCL = 62.0$ cm) was collected in Charleston Harbor on 13 September 1991. The five green turtles captured had SCL measurements from 46.6 to 98.5 cm. The two largest green turtles were captured in Canaveral Harbor (52.0 and 98.5 cm). Because only 20 Kemp's ridley and 5 green turtles were captured, the analyses (except for CPUE calculations) that follow are based primarily on loggerheads.

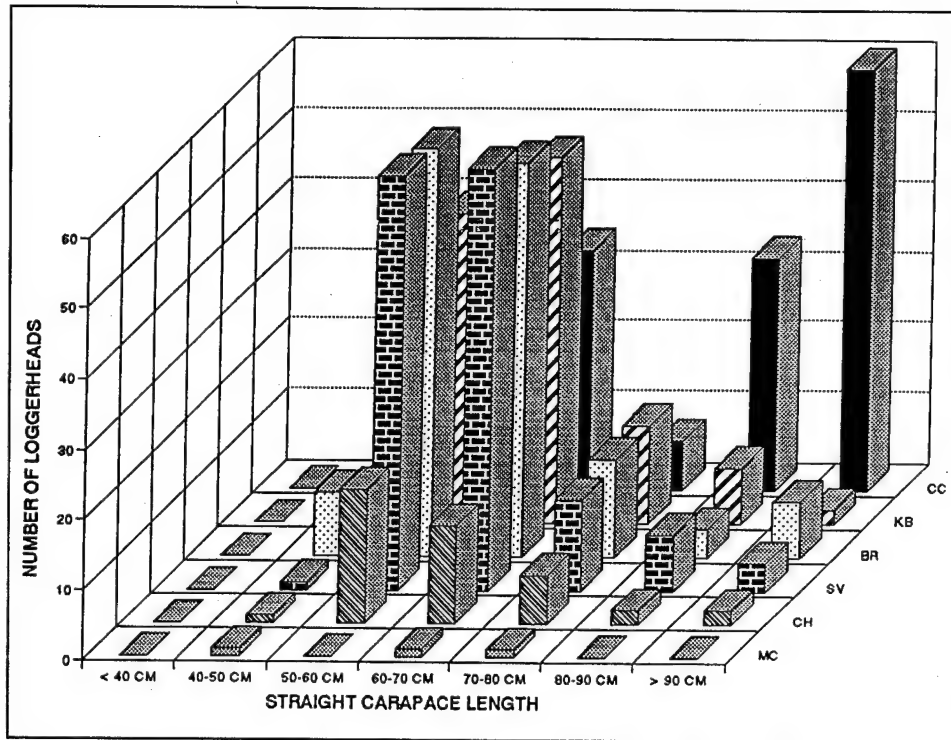


Figure 4. Distribution of SCL for loggerheads captured from June 1991 through March 1993. (CC = Canaveral Harbor, KB = Fernandina Harbor, BR = Brunswick Harbor, SV = Savannah Harbor, CH = Charleston Harbor, MC = Morehead City Harbor)

Sex ratios (Table 26) reflect only field identifications based on size-class and external morphological characteristics. A large number of unknown sex are shown since the majority captured were juveniles.

CPUE was calculated as number of turtles captured per hour (Table 27), number of turtles captured per trawl (Table 28), and number of turtles captured per nautical mile (Table 29). CPUE calculations are given as indices to facilitate comparisons between the channels. Caution should be used when comparing CPUE calculations throughout the entire sampling period of this study since sampling protocol was changed for the latter surveys; however, general trends can be determined (Figure 6). CPUE comparisons should be reserved for those surveys with comparable sampling design.

Spatial (Station) Distribution

The number of turtles captured, hours trawled, and CPUE for each sampling station and channel are presented in Table 30. For each channel, sampling station 1 represents the inshore station and the highest numbered station represents the offshore station. With the exception of Morehead City and

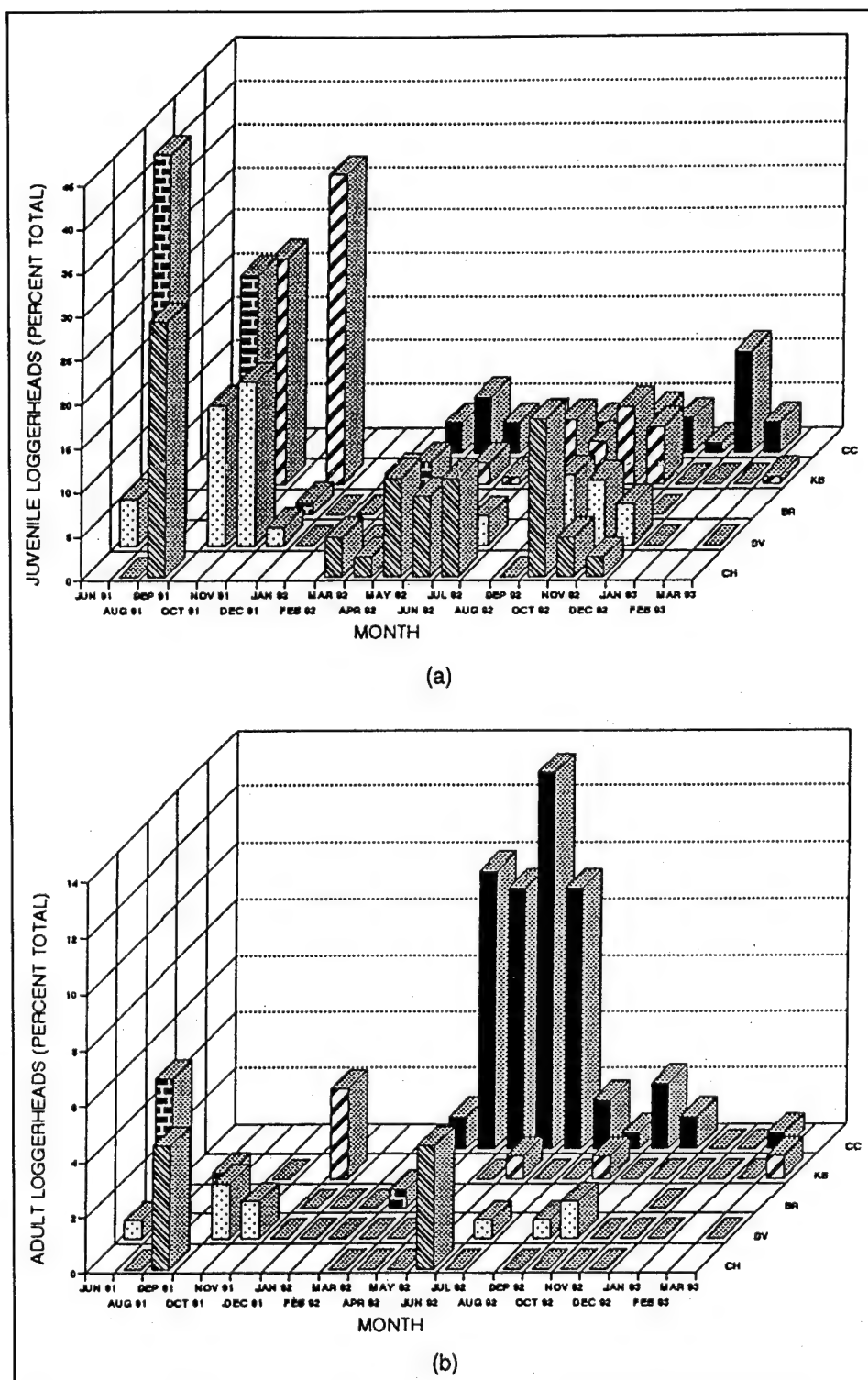


Figure 5. Distribution of (a) juveniles and (b) adult loggerheads captured from June 1991 through March 1993

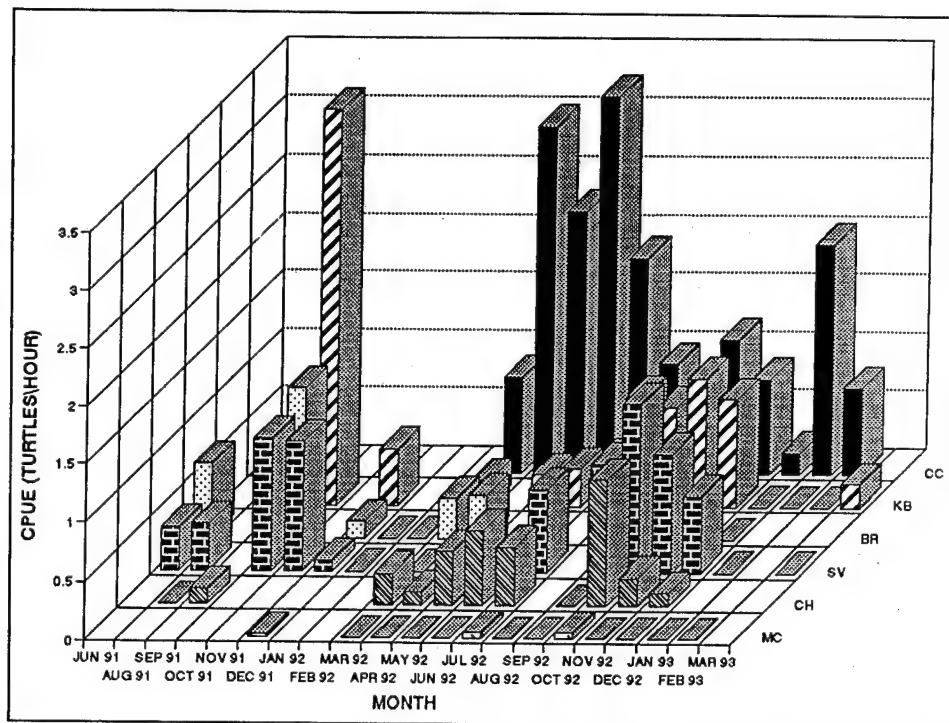


Figure 6. Distribution of monthly CPUE (turtles/hour) (loggerheads only) from June 1991 through March 1993

Charleston Harbor, there is a significant difference among the total numbers of turtles captured at each station in Canaveral, Fernandina, and Savannah Harbors ($df = 3$, chi-squares = 99.9, 13.08, and 8.67, respectively). Stations with the highest percent total number of captures within a given channel were station 3 (48.6%) for Canaveral Harbor, station 2 (42.3%) for Fernandina, and station 4 (40.7%) for Savannah (Figure 7). These differences in station distributions are also reflected in the CPUE calculations; however, there was no consistent pattern in relation to distance from shore (Table 30). This suggests that other factors contributed to the higher occurrence in certain stations. Analyses for spatial distribution were not done for Brunswick Harbor since station sampling protocol was only used during the December 1992 surveys.

Seasonal Distribution

CPUE (turtles per hour) was calculated with all species for spring (March, April, May), summer (June, July, August), fall (September, October, November), and winter (December, January, February) (Table 31). The CPUE calculations with Fernandina, Brunswick, Savannah, and Charleston Harbors combined for spring, summer, fall, and winter were 0.220, 0.515, 0.718, and 0.181 turtles per hour, respectively. The CPUE calculations for Canaveral Harbor for spring, summer, fall, and winter were 2.041, 2.041, 0.764, and

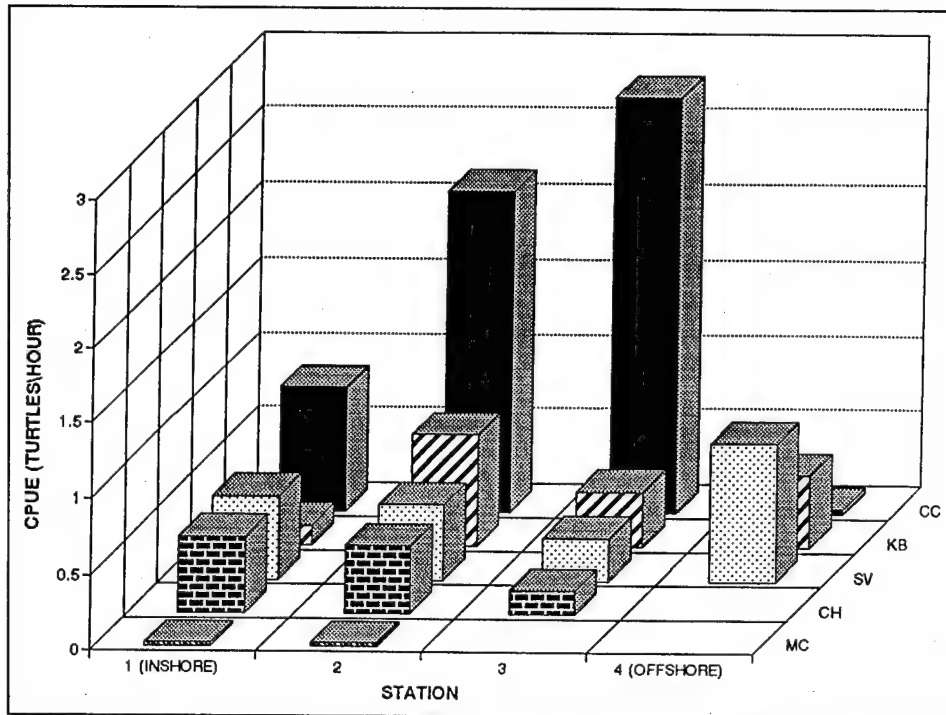


Figure 7. CPUE rates (turtles/hour) by sampling stations

0.963 turtles per hour. The CPUE calculations for Morehead City Harbor for spring, summer, fall, and winter were 0, 0.047, 0.048, and 0.020 turtles per hour. The distribution of sea turtles captured in the four channels north of Canaveral Harbor, primarily juvenile loggerheads, increased in late spring, steadily increased through summer, and peaked in fall (Figure 8). For Fernandina, Brunswick, Savannah, and Charleston Harbors, turtles started returning to the channel by early April and were present through the first weeks of December. Peak month for both juvenile and adult loggerhead captures appears to be October for these four channels.

This was not seen in Canaveral Harbor where the highest percent composition of adult loggerheads was in late spring through summer (Figure 5). Peak months for adult male loggerheads were April and May; whereas, peak months for adult female loggerheads were June and July (Figure 9). Adult female loggerheads are present in Canaveral Harbor during the summer nesting months. Adult male loggerheads were primarily seen in late spring prior to the nesting season. Although juveniles are abundant during every month of the year in Canaveral Harbor, the peak month for occurrence was January. In Canaveral Harbor, sea turtles remained throughout the fall and winter months, but at reduced abundance (loggerheads) (Figure 6). Juvenile loggerhead abundance sharply increased during January at Canaveral Harbor, while it was severely reduced or absent at the other five channels.

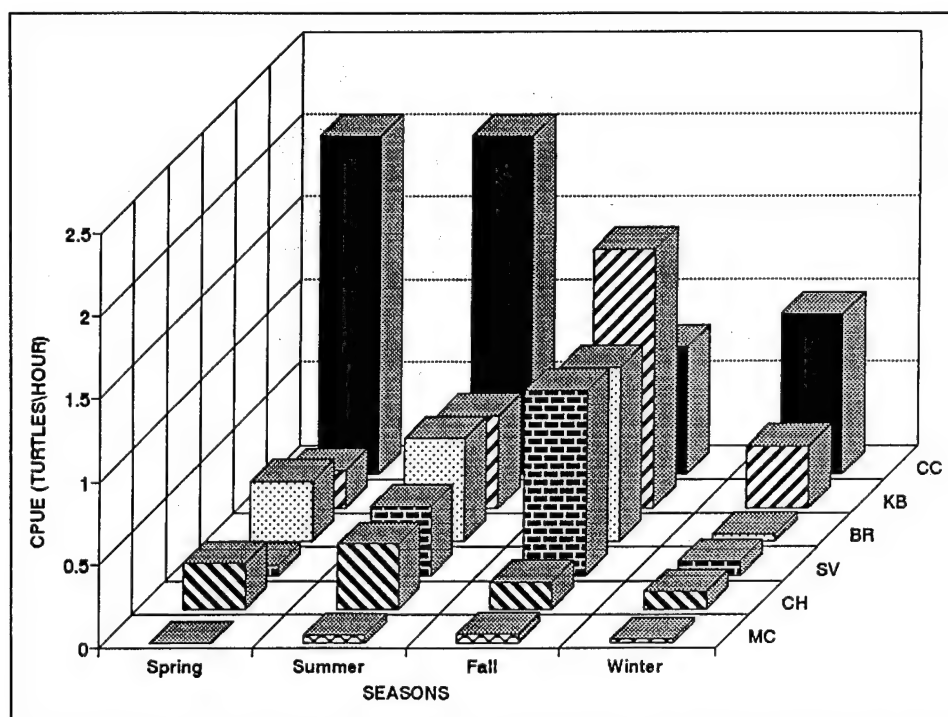


Figure 8. CPUE rates (turtles/hour) by seasons. Spring = March, April, May; Summer = June, July, August; Fall = September, October, November; Winter = December, January, February

Kemp's ridley capture trends were higher during fall and early winter. The five green turtles were captured during the months of March, April, June, and December. Because of the small number of Kemp's ridley and green turtles captured very little can be inferred on seasonal occurrence for either of these species.

Environmental Parameters

Most surveys were not conducted during extremely rough weather; however, mean range of wave heights during the monthly surveys was from calm to 9 ft. There was no apparent effect of sea state on turtle captures.

Monthly mean water and air temperatures for each channel are shown in Tables 32 and 33. Canaveral Harbor consistently maintained the warmest water temperature of the six channels. Water temperatures less than 16 °C were not recorded at Canaveral Harbor during these surveys. The coldest (6.2 °C) and widest range (6.2 to 28.7 °C) of water temperatures were seen at Morehead City Harbor. The range of water temperatures recorded at Fernandina, Brunswick, and Charleston Harbors were similar (10.9 to 30.4 °C).

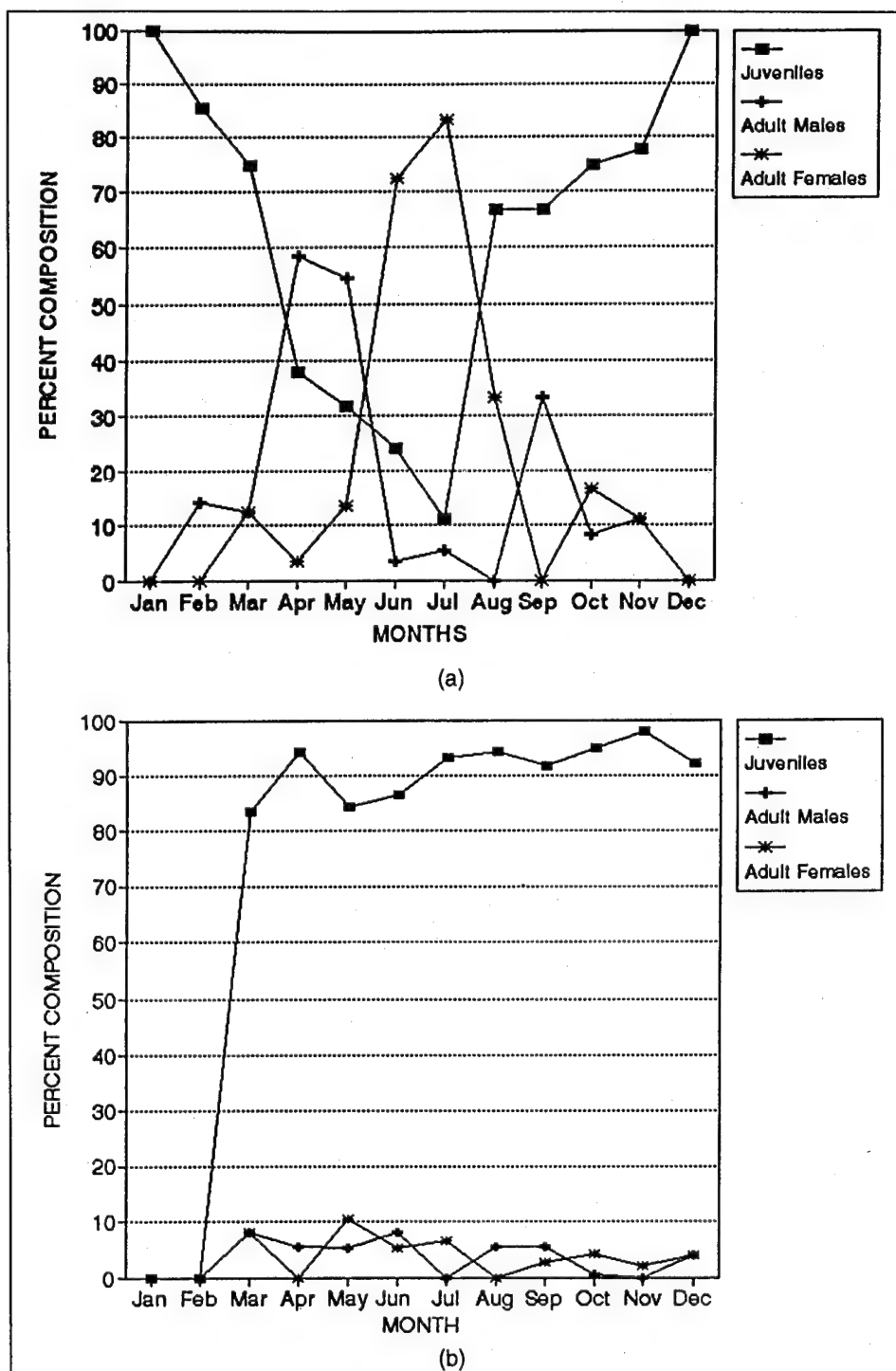


Figure 9. Percent composition of loggerhead turtles, in three sex categories (adult male, adult female, and juveniles) captured in (a) Canaveral Harbor, Florida, and (b) Fernandina Harbor, Florida, Brunswick Harbor, Georgia, Savannah Harbor, Georgia, and Charleston Harbor, South Carolina. Based on data collected from June 1991 through March 1993

There is a clear relationship between turtle capture rates and water temperature (Figure 10 and Table 34). Densities of turtles were generally higher during warmer months (Figures 11-13). Of the total 670 turtles captured, 500 were collected when water temperatures were ≥ 21 °C. While only 148 (22%) turtles were captured in water temperatures 17-20 °C. In the five channels surveyed north of Canaveral Harbor, 109 (22%) turtles were captured during October through December and March through April with water temperatures 17-20 °C. A total of 22 turtles were captured with water temperatures ≤ 16 °C and only one turtle was captured when water temperatures were ≤ 14 °C (13.6 °C in December 1991 at Morehead City Harbor). In Fernandina, Brunswick, Savannah, and Morehead City Harbors no turtles were captured during January, February, or March of either 1992 or 1993 when water temperatures were below 14 °C. No turtles were captured in either Fernandina Harbor or Morehead City Harbor during the December 1992 surveys when mean water temperatures were 14.7 °C and 15.9 °C, respectively.

From 1 December 1992 through 31 March 1994, only nine sea turtles (7 loggerheads, 1 Kemp's ridley, 1 green) were entrained.¹ Two of these turtles were entrained when the water temperature was 18-19 °C; however, 6 were taken when water temperatures ranged from 15 to 17 °C. The channel, species, date, and water temperature for each of these incidents are as follows: Savannah Harbor, 4 loggerheads (2 December 1992, 18 °C; 15 March 1994, 16.7 °C; 21 March 1994, injured, 16.7 °C; 24 March 1994, 17.2 °C) and one Kemp's ridley (24 March 1994, injured, 17.2 °C); Fernandina Harbor, 2 loggerheads (9 January 1994, 15.6 °C; 20 March 1994, 16.7 °C); Morehead City Harbor, 1 loggerhead (2 April 1994, 15.5 °C); and Ft. Pierce Inlet, Florida, one green turtle (11 January 1994, 18.9 °C).

Relocation

Relocation operations conducted during June 1991 at Brunswick Harbor relocated 70 turtles approximately 6 to 12 nm out of the channel. Only one was recaptured. A total of 27 turtles were relocated during June 1991 at Savannah Harbor and none were recaptured. During 24 days of relocation efforts at Fernandina Harbor in December 1991, 48 turtles were relocated and none recaptured. During 4 days of relocation efforts in March 1992 at Charleston Harbor, 3 turtles were captured before dredging operations were completed.

Relocation operations were generally not begun until the latter portion of a dredging project making assessment of the effectiveness of the technique difficult. However, it should be noted that during the first 66 days of the dredging project at Brunswick Harbor, 21 sea turtle entrainment incidents were documented prior to the initiation of relocation efforts while only one entrainment

¹ Personal communication, M. Dupes, S. Calver, and B. Adams.

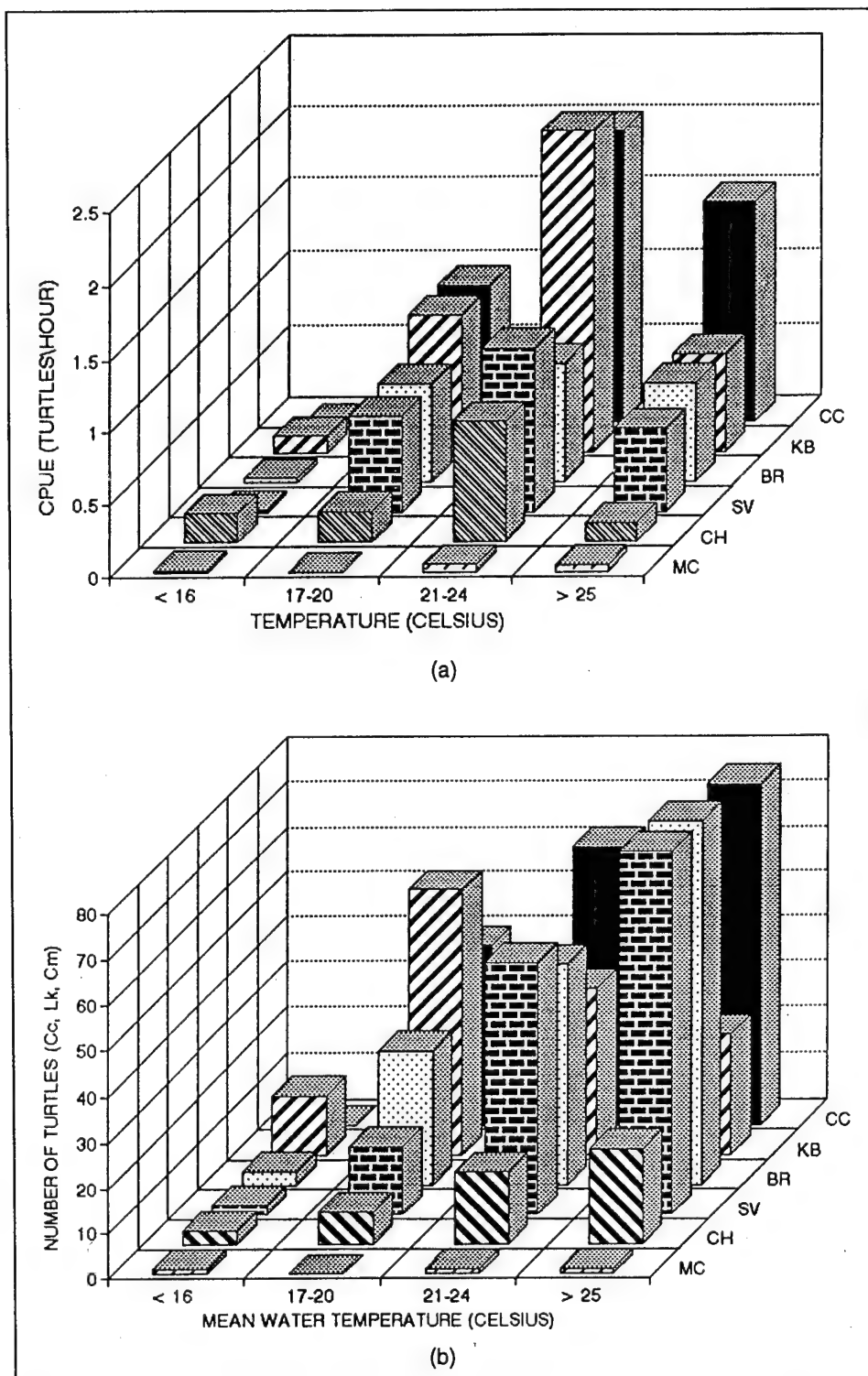


Figure 10. (a) CPUE rates (turtles/hour) and (b) distribution of turtles captured (all species combined) referenced to mean bottom water temperature ($^{\circ}\text{C}$)

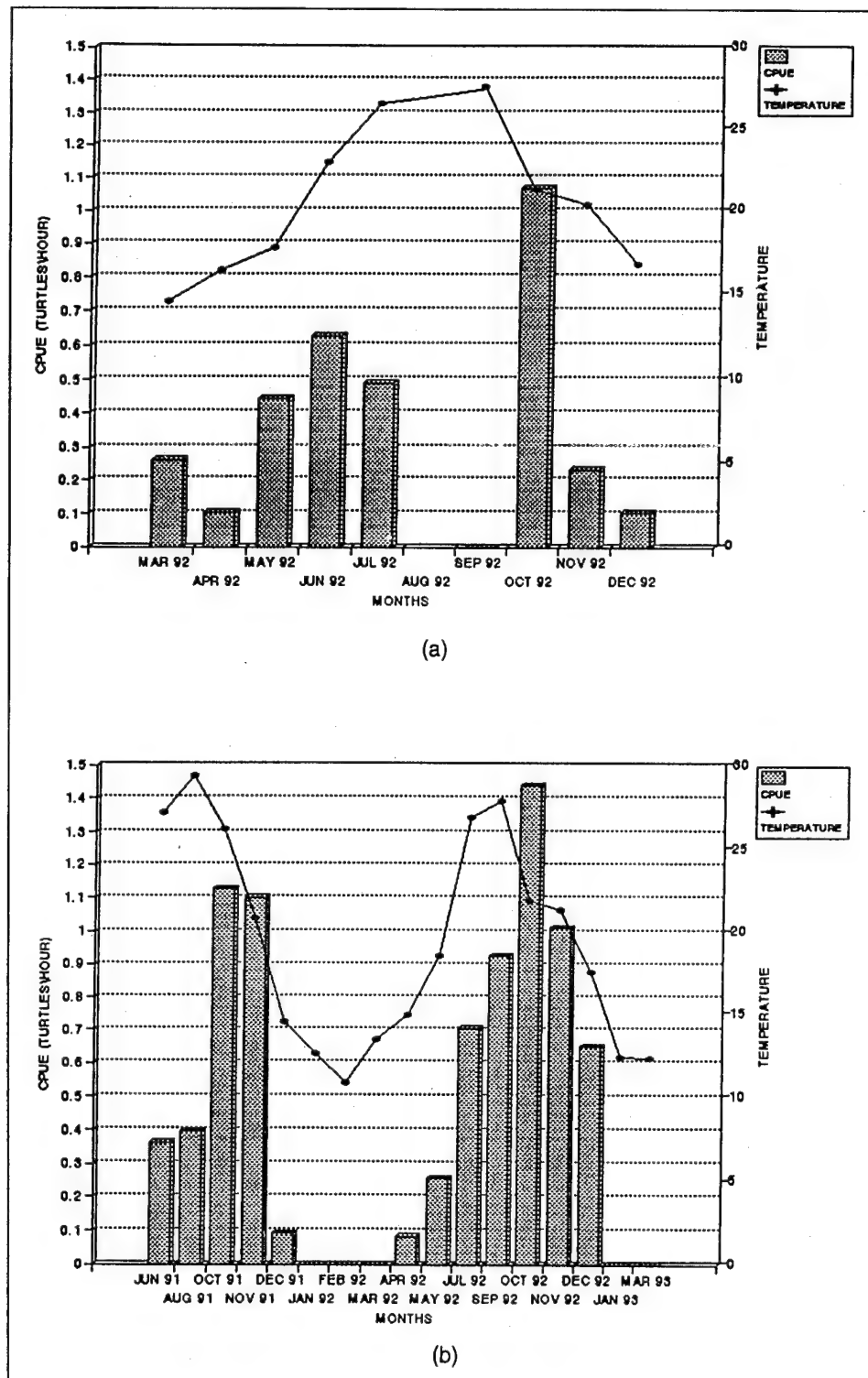


Figure 11. Monthly CPUE rates (turtles/hour) (all species combined) and mean bottom water temperature (°C) for (a) Charleston Harbor entrance channel, South Carolina, and (b) Savannah Harbor ocean bar channel, Georgia

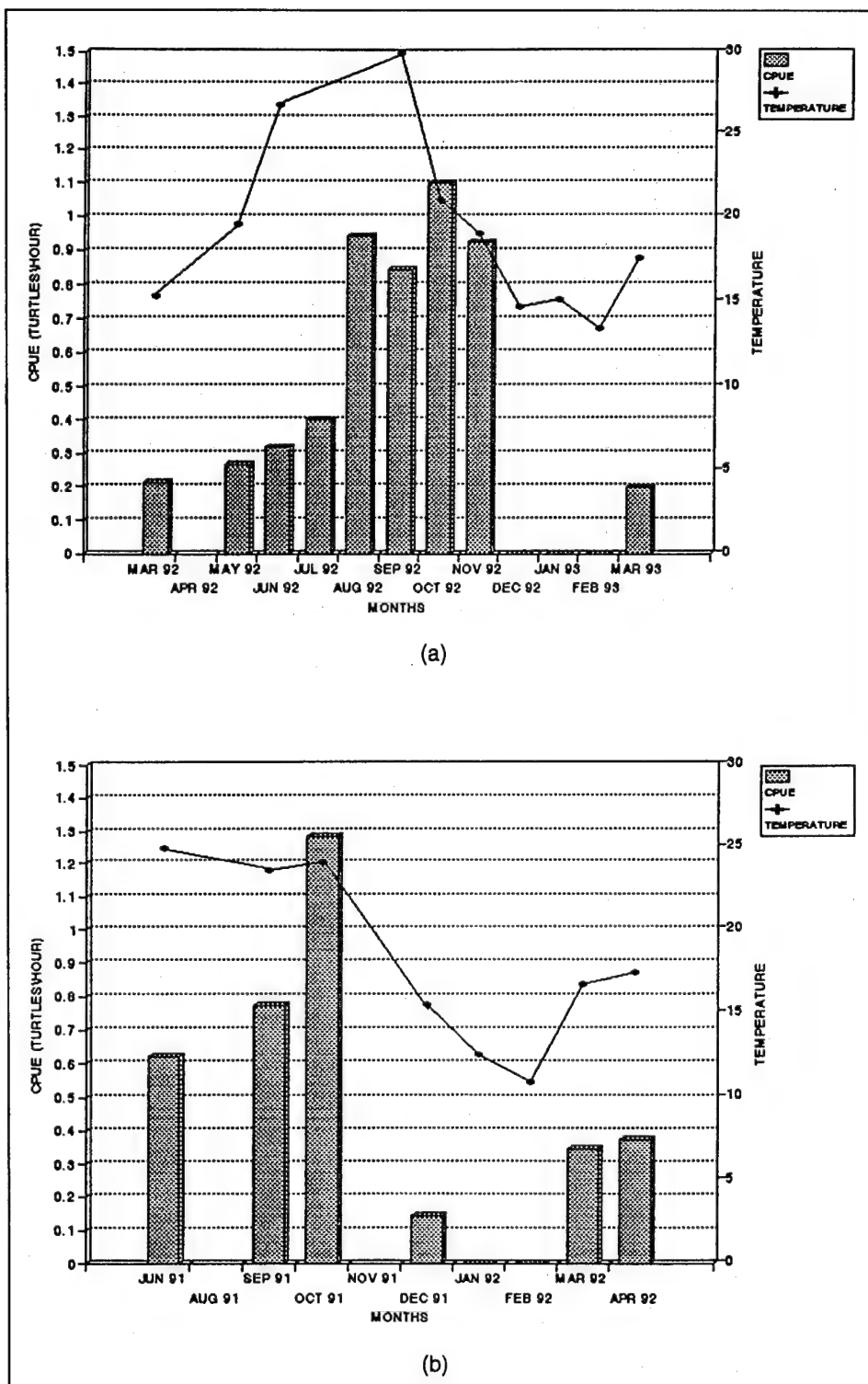


Figure 12. Monthly CPUE rates (turtles/hour) (all species combined) and mean bottom water temperature (°C) for (a) Fernandina Harbor St. Marys River entrance channel, Florida, and (b) Brunswick Harbor ocean bar channel, Georgia

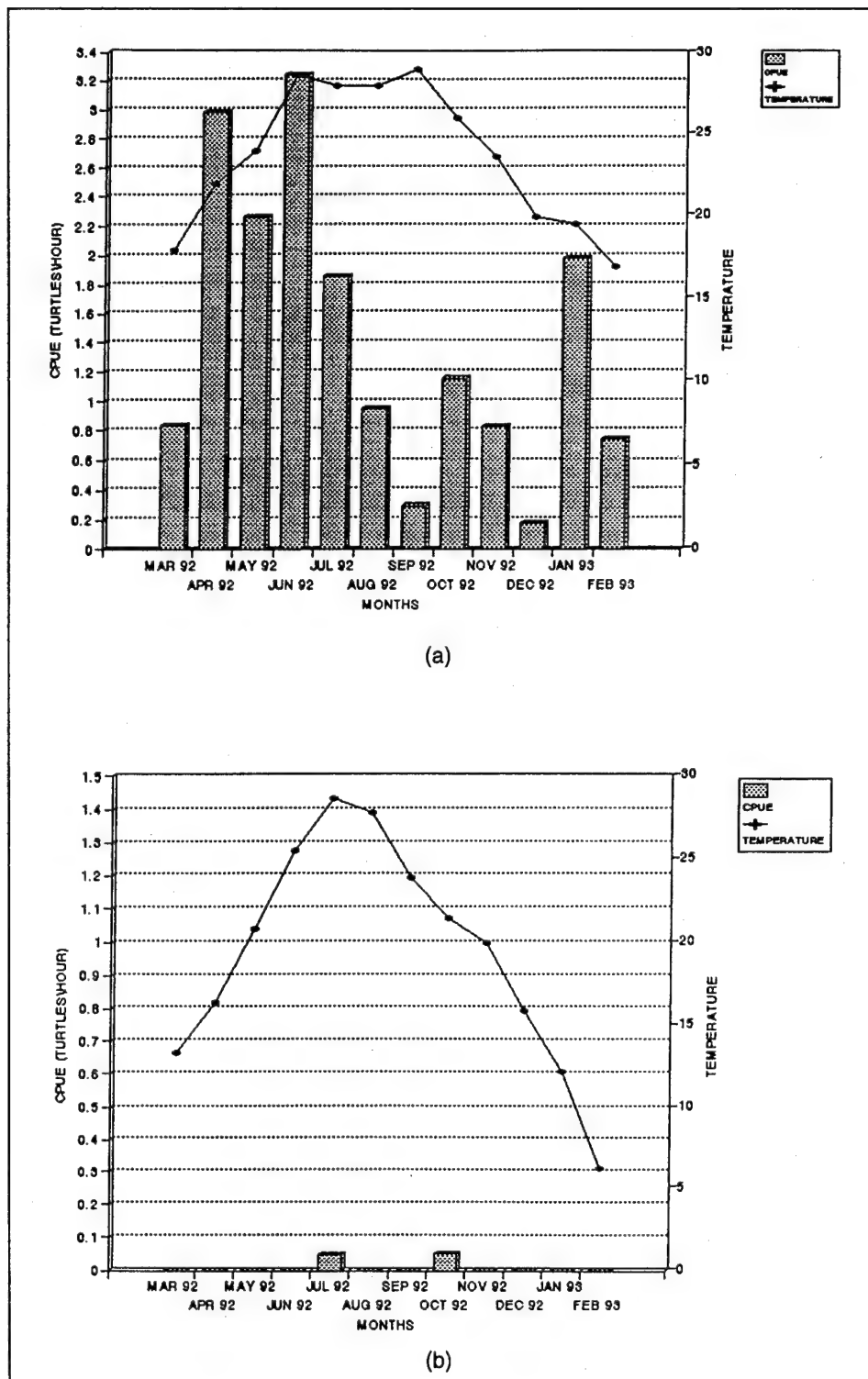


Figure 13. Monthly CPUE rates (turtles/hour) (all species combined) and mean bottom water temperatures (°C) for (a) Canaveral Harbor entrance channel, Florida, and (b) Morehead City Harbor entrance channel, North Carolina

incident was documented in the 25 days thereafter. Similarly, 17 sea turtle entrainment incidents were documented during the first 10 days of the dredging project at Savannah Harbor prior to the initiation of relocation efforts and none were reported in the 14 days when relocation trawling was used. No sea turtle entrainments were reported during the 55 days of dredging in 1991/1992 at Fernandina Harbor. No turtles were captured by trawl once water temperatures dropped to 14.5 °C; therefore, relocation efforts were discontinued at Fernandina Harbor before dredging was completed.

Recaptures

Data on recaptured sea turtles are listed in Appendix D. Loggerheads were the only species recaptured in all channels. Out of 76 monthly sampling efforts, only eight turtles (1.2%) were recaptured during the same month in which they were first captured and tagged (Charleston Harbor, 1; Savannah Harbor, 3; Brunswick Harbor, 2; Fernandina Harbor, 2). These eight recaptures were all during months of high relative abundance (June, 2; July, 1; October, 3; and November, 2).

A total of 58 loggerheads (8.7%) were recaptured from prior sampling efforts either during these or other studies (Charleston Harbor, 7; Savannah Harbor, 14; Brunswick Harbor, 6; Fernandina Harbor, 8; Canaveral Harbor, 23). Twenty-nine of these were recaptured within the same channel in which they had originally been captured and tagged. One loggerhead recaptured in Canaveral Harbor on 8 July 1992 had originally been captured and tagged 3.7 years earlier in Canaveral Harbor on 9 November 1988. Data on locations and the number of days between captures for these turtles are given in Appendix D. Data are unavailable on 20 turtles captured which were tagged previously by other sea turtle projects.

Information obtained from the previously existing flipper tags on nine loggerheads shows evidence of large-scale movement between the South Atlantic channels. Although most recaptured turtles were first captured and tagged within the South Atlantic, one loggerhead was originally tagged in August 1991 in Southold Bay, New York, and recaptured in April 1992 at Savannah Harbor. One loggerhead tagged at Brunswick Harbor in April 1992 was recaptured in October 1992 at Charleston Harbor. During March 1992 at Brunswick Harbor two loggerheads were recaptured which were previously captured in October 1991 at Fernandina Harbor and Savannah Harbor. Two loggerheads tagged in June 1990 at Brunswick Harbor and in June 1991 on Bald Head Island, North Carolina, were both recaptured at Fernandina Harbor in December 1991. Three loggerheads recaptured at Canaveral Harbor in April 1992, October 1992, and January 1993 were previously tagged at Kennedy Space Center, Florida (January 1990), St. Lucie, Florida (February 1989), and Fernandina Harbor (August 1992).

Three turtles (one green turtle, two loggerheads) nested a short time after they were captured at Canaveral Harbor; therefore, the capture in the trawl

survey did not appear to disrupt reproductive behavior for these three females (Bolten et al. 1993). A green turtle captured on 19 June 1992 later nested on 7 July 1992 at Melbourne Beach, Florida. One loggerhead originally captured on 19 June 1992 nested on Hutchinson Island, Florida, on 9 July 1992 and a second loggerhead captured on 10 July 1992 nested on Cocoa Beach, Florida, on 30 July 1992.

One loggerhead (X 2674/2675) which was captured on 19 June 1992 in Canaveral Harbor and noted to be lethargic with a sunken plastron, stranded dead three days later 3.6 km north of Canaveral Harbor jetties (Bolten et al. 1993). A second adult male loggerhead (X 2626/2627) which was captured during the May 1992 survey, stranded dead in Chesapeake Bay in June 1993. These mortalities did not appear to be attributed to capture during the trawl surveys.

5 Discussion

Species Composition, Size Frequency, Relative Abundance

Loggerheads dominated species composition in all six channels. Since only three loggerheads were captured at Morehead City Harbor, very little can be concluded except that there was a low abundance of sea turtles in the dredged portion of this channel during the monitoring period. Only 20 Kemp's ridleys were captured within the deeper dredged areas surveyed during this study. The presence of Kemp's ridleys, however, may be higher in shallower areas which potentially serve as an important habitat (National Research Council 1990). Kemp's ridleys occur along the South Atlantic coastal area; however, little information is available on their utilization of deeper dredged areas within the channels. The extremely low relative abundance of Kemp's ridleys seen during this study may be a result of their infrequent use of the deeper channel or a reflection of a rare occurrence by an extremely endangered animal. Only five green turtles were captured during this study. Smaller green turtles exist in the shallower areas, as do the Kemp's ridleys, and may not frequent the deeper waters of the channels (Mendonca and Ehrhart 1982; Ehrhart 1983; Mendonca 1983; Renaud et al. 1993; Landry et al. 1993). Juvenile and adult Kemp's ridley and green turtles do not appear to utilize the deeper dredged portions of the six channels surveyed; however, both species occur throughout the South Atlantic and periodically are found within the deeper channels.

Very little can be determined from the small numbers of Kemp's ridley and green turtles captured. However, 17 of the 20 Kemp's ridleys captured were at Fernandina Harbor and Brunswick Harbor. Fernandina, Brunswick, and Savannah Harbors are the only channels in which documented Kemp's ridley mortalities or injuries from hopper dredges have occurred (Table 2). Green turtle mortalities or injuries are documented at Canaveral, Fernandina, and Ft. Pierce Harbors, Florida; however, during this survey a total of only three green turtles were captured from Canaveral Harbor and Fernandina Harbor. Previous dredging records from Canaveral Harbor indicate that most of the green turtles killed or injured were very small juveniles which were potentially taken by the dredge inside the jetties or near the turning basin of the

submarine base.¹ This location has many submerged rocks and debris which prevents trawling. Tangle netting techniques used at this location have yielded a large number of small juvenile green turtles presumably using the submerged structures for protection and feeding (Mendonca 1983). Dredging records from Fernandina Harbor are inconclusive as to the locations where green turtles were killed or injured.

The species distributions of reported turtle entrainments summarized in Table 2 show that the majority of identified entrained turtles were loggerheads (63 %), with green turtles accounting for 12 %, and Kemp's ridleys 2 %. Unidentified turtles accounted for 23 % of the total entrainment incidents reported and were identified as turtles by portions of the body or internal viscera. Most of these specimens were assumed to be loggerheads but were not counted in the loggerhead totals. Loggerheads dominated these entrainment totals and this domination was also demonstrated by the trawling survey catches.

Loggerheads smaller than 40 cm were not captured during this study. This may be a result of smaller animals occupying the shallower areas outside the deeper dredged areas which was reported for smaller Kemp's ridley and green turtles. Juvenile loggerheads less than 40 cm do not appear to utilize any of the surveyed channels. Juveniles of the 50- to 70-cm size classes did utilize the channels; however, it is not known whether this reflects habitat use different from that in shallower habitats of the surrounding area. The size frequency of loggerheads captured in the five channels surveyed north of Canaveral Harbor is strongly dominated by the 50- to 70-cm juvenile size class. Van Dolah and Maier (1993) reported similar species composition and size-class distributions from their trawling surveys in Charleston Harbor.

Analysis of the relative contribution of an individual of a given age to the growth rate of the population (reproductive value) provides valuable insight for management decisions in the conservation of sea turtles, because it indicates which individuals contribute most to future populations and also, by inference, where protection is likely to be the most effective (Richardson and Richardson 1982; Crouse, Crowder, and Caswell 1987). Richardson and Richardson (1982) analyzed reproductive value for loggerhead eggs and hatchlings, small juveniles, large juveniles, subadults, and nesting adults at Little Cumberland Island, Georgia, and determined the highest reproductive value was with the older stages, particularly the large juveniles 58-79 cm long. This was the dominant size-class captured in the surveyed channels. Increased efforts to protect this group are considered extremely important in conservation practices (Richardson and Richardson 1982; National Research Council 1990).

Although only 34 (7%) of the 470 loggerheads captured at Fernandina, Brunswick, Savannah, and Charleston Harbors were adults, this does not preclude the occurrence of adult loggerheads throughout the surrounding coastal

¹ Unpublished Endangered Species Observer reports. Personal communication, C. Slay.

area outside the channel. Adult loggerheads are known to occur in these areas in significant numbers, especially with respect to nearby nesting beaches (National Research Council 1990). The low relative abundance of adult loggerheads seen in this study may reflect low abundance relative to juvenile loggerheads, infrequent use of the deeper channel, or avoidance of the trawl nets. Without additional information, the trawl survey information can only be assumed to indicate a low relative abundance of adult loggerheads within the deeper dredged areas of Fernandina, Brunswick, Savannah, and Charleston Harbors.

Size class distribution at Canaveral Harbor was dramatically different than the other channels surveyed. Whereas only a small number of adults were captured in the channels north of Canaveral Harbor, 48.3% of the loggerheads captured at Canaveral Harbor were considered adults. Unlike the other channels, the deeper dredged portions of Canaveral Harbor were heavily used by both male and female adult loggerheads. Large numbers of adult loggerheads are also known to nest at nearby beaches (National Research Council 1990).

Fritts et al. (1983) indicated that the distributions of large loggerheads were related to water depth rather than to distance from shore. Data on depth distribution are scarce; however, limited aerial surveys in the Gulf of Mexico indicate sea turtles are most abundant in waters less than 50 m. Limited trawling and biotelemetry data indicate that juvenile and adult sea turtles off the South Atlantic and Gulf coasts are most abundant in waters less than 27 m deep but seldom inhabit water less than 4 m deep (Bullis and Drummond 1978; Byles 1988).

Seasonal Distribution

Surveys conducted in Fernandina, Brunswick, Savannah, and Charleston Harbors show similar results. Loggerhead captures begin in late spring, CPUE steadily increases throughout the summer to a peak in fall, then dramatically decreases as the sea turtles leave in winter. CPUE rates indicate that fall (September, October, November) is the time of highest relative abundance for loggerheads and October is the peak month for juvenile and adult loggerheads. Additional sampling is necessary to confirm the fall trend of peak occurrence.

Even though the nesting season at nearby beaches is primarily May through August, adults do not appear to utilize deeper portions of these channels during this time and may only use it as a temporary post-nesting habitat before leaving. Van Dolah and Maier (1993) also noted very few adult females in Charleston Harbor even though they are commonly found nesting in the area during spring and summer. Data from Canaveral Harbor show a very different seasonal distribution for both juvenile and adult loggerheads. Juveniles occupy Canaveral Harbor year round in relatively constant numbers; whereas, adults move into the channel and surrounding area during the spring/summer breeding season. Adult female loggerheads appear to use Canaveral Harbor as an inter-nesting habitat and adult males are found in the channel in late spring

prior to arrival of the females. Similar conclusions were reached by Henwood (1987).

A sharp increase in the number of juveniles in January at Canaveral Harbor (this study and Henwood 1987) may represent juvenile turtles migrating south during cooler temperatures. Biotelemetry studies may aid in understanding the migratory and behavioral patterns of juvenile and adult loggerheads.

Spatial (Station) Distribution

The spatial distribution of loggerheads within Canaveral, Fernandina, and Savannah Harbors indicates differential use between the stations surveyed; however, it is difficult to interpret these data without an understanding of what factors attract sea turtles to these channels. The distribution may be correlated with factors such as temperature, turbidity, current regime, bottom topography, substrate, depth, or availability of food organisms. These factors may also be highly variable between channels, seasons, and years. Although no conclusions can be drawn, the relative abundance of turtles between stations suggests a preference for station 2 at Fernandina Harbor, station 3 at Canaveral Harbor, and station 4 (furthest offshore) at Savannah Harbor. Van Dolah and Maier (1993) showed differences in density of loggerhead turtles among stations; however, this was not seen in this study. This suggests some feature(s) within the channels which may attract these animals; however, further studies would be needed to identify the factor(s).

Relocation

During early dredging projects at Canaveral Harbor, trawling was utilized to relocate turtles from the dredged area of the channel. In 1980, at Cape Canaveral, 1,250 loggerheads were relocated 5 miles south of the channel during four months of relocation efforts (Joyce 1982). Many of these displaced animals returned to the channel during the same dredging project. Relocation efforts in December 1989 and January 1990 at Canaveral Harbor relocated 36 turtles (31 loggerheads; 4 green turtles; and 1 Kemp's ridley) with no animals recaptured during the 15 days of trawling (Bolten and Bjorndal 1991). Ninety-three turtles (91 loggerheads and 2 green turtles) were caught and removed from the vicinity of the dredging operation at Canaveral Harbor with no recaptures from 30 December 1990 to 15 January 1991 (Bolten and Bjorndal 1991). Relocation efforts in Brunswick, Savannah, Fernandina, and Charleston Harbors during this study relocated a total of 160 turtles (155 loggerheads, 4 Kemp's ridley, and 1 green turtle) with only one displaced turtle recaptured during the trawling activities. Additionally, a reduced number of entrained turtles were

reported by the observers on the dredges when relocation trawling was utilized.¹

The relative success of relocation efforts in channels with high densities of sea turtles is uncertain because of the inability to move the large numbers of turtles found in the channel in some years and the tendency for some turtles to return to the channel once removed. The success of trawling operations is difficult to evaluate; however, relocation of turtles out of the channel may be feasible when there are low densities of turtles. Recapture rate of relocated turtles may also be reduced by releasing the turtles at greater distances than 5 to 12 nm. To increase the potential for reducing the number of entrained turtles in future dredging projects, trawling operations used to relocate turtles should begin shortly before or at least at the onset of the dredging operation and not delayed until the latter portion of the project.

Although turtles may be present throughout these channels, the trawlers usually have difficulty pulling nets inside jetties or nearshore because of rocks, old pilings, or debris which may snag and tear the nets. Turtle relocation operations are limited to areas in the channels where trawling is possible; however, trawling should be done throughout as much of the channel as possible.

Recaptures

The low number of recaptures throughout the study may be explained several ways. The number of sea turtles in the area may actually be large but only a small portion of the sea turtle population is being sampled. The individuals captured may temporarily move out of the surveyed area of the channel upon release (Standora, Morreale, and Bolton 1993; and Nelson²). Once captured by trawling nets, the sea turtles may also exhibit an avoidance behavioral response to subsequent encounters with the nets. Behavioral studies using biotelemetry techniques suggest an avoidance response in some individuals (Standora et al. 1994). No quantitative information is available from these low numbers of recaptures but there is some evidence that some individuals may stay in the channel area for an extended period of time, as well as migrate back to the same general area from their warmer winter retreats. Recaptures of individuals from multiple channels confirm the fact that these animals migrate wide latitudinal distances along the Atlantic coast.

¹ Unpublished Endangered Species Observer reports. Personal communication, C. Slay.

² Unpublished data, Nelson, USACEWES.

Water Temperature and Relative Abundance

Sea turtles are ectothermic; therefore, the temperature of their immediate surroundings is an important factor in their physiological requirements. Hypothermia in sea turtles is known to cause a comatose condition and may result in death (Wilcox 1986; Witherington and Ehrhart 1989; Schroeder et al. 1990). Sea turtles may respond to colder water temperatures by migrating to warmer water either in more southerly locations or offshore to the Gulf stream (Thompson 1988). They may also spend more time basking at or near the surface to increase their body temperature through solar heating (Carr 1952 and Nelson¹). It has been suggested that sea turtles may be able to survive cold temperatures during winter months by burying themselves in the channel bottom and going into a state of protected hibernation (brumation) (Felger, Clifton, and Regal 1976; Carr, Ogren, and McVea 1980; Clifton, Cornejo, and Felger 1982; Lutz 1990). During two unusually cold winters in 1978 and 1979 at Canaveral Harbor, the presence of large numbers of loggerhead sea turtles in the channel was brought to the attention of the scientific community by fishermen who had incidentally captured a number of turtles in a torpid condition by trawling. Loggerheads were reported to be buried in the anoxic mud for undetermined periods of time in Canaveral Harbor and in the Gulf of California (Felger, Clifton, and Regal 1976; and Carr, Ogren, and McVea 1980). Since potential brumation in sea turtles is reported only rarely in the literature and the trawling surveys in this study did not capture turtles with evidence of having been buried in mud during times of cold water temperature, this is believed to be a very rare event. This rare event may occur during short periods of unusually cold water temperatures with those turtles which overwinter at Canaveral Harbor; however, since sea turtles do not appear to overwinter in the channels north of Canaveral Harbor, it is unlikely this would occur in those channels. Richardson and Hillestad (1979) also reported no evidence of sea turtles overwintering in navigation channels in South Carolina and Georgia.

Sea turtle abundance has been found to be higher in southeastern Atlantic channels during the warmer months. A gradual northward expansion of the sea turtle's range during spring and summer months may be a result of physiological dependence on warmer temperatures, as well as a reflection of increased food availability (Shoop, Doty, and Bray 1981). Henwood and Ogren (1987) noted higher concentrations of Kemp's ridleys occurred near Canaveral Harbor from December to March suggesting that these turtles overwinter in this area and disperse along the Atlantic coastline with increasing water temperatures. Biotelemetry studies of migrating loggerheads in offshore waters revealed they spent more time at the surface than individuals in estuarine foraging habitats (Keinath, Musick, and Byles 1987). These offshore migrating turtles may be nearer the surface to benefit from the warmer surface water, as well as to breath more frequently.

¹ Unpublished data, Nelson, USACEWES.

Water temperature may serve as a preliminary mechanism for predicting the potential for sea turtle occurrence in an area. There is no evidence in this data set, as suggested by Van Dolah et al. (1992), that a regression relationship exists for sea turtle capture rate and water temperature. Rather there is an apparent threshold below which the chance of sea turtle capture is remote. This can also be demonstrated with the results presented by Van Dolah et al. (1992). For the channels surveyed north of Canaveral Harbor, 16 °C water temperature was used as the dividing point. During this study, 1,008 trawls conducted at or below 16 °C resulted in a total of 22 (4.4%) captures while 1,791 trawls conducted above this temperature resulted in a total of 473 (95.6%) captures. This clearly indicates a reduced relative abundance when water temperature is at or below 16 °C. This relationship was absent at Canaveral Harbor because water temperature did not drop below 16 °C. The higher critical minimum water temperatures found in Florida throughout the year may be a major factor supporting sea turtle occurrences year-round (Fritts et al. 1983).

Although the lower critical temperature limits may be different for each species and size-class, temperatures below 16-20 °C may be used as a conservative indicator of time periods in channels north of Canaveral Harbor which have reduced sea turtle occurrence. Caution should be taken when temperature is used as the only indicator of potential sea turtle activities in a given area until further studies can be performed. Additional work is also needed to understand the behavioral patterns of these animals during the colder seasons.

Caution should be taken when using absolute dates from this study for arrival and departure of sea turtles. Extensive weekly surveying efforts need to be conducted in the spring and fall months to better define temporal movement patterns for the turtles. Since water temperature may vary significantly between years, mean water temperature should be used as a relative index in addition to CPUE indices from trawl surveys and historical trends for predictions of relative abundance and seasonal occurrence of sea turtles. Successful interpretation of potential relative abundance of sea turtles is dependent on conducting trawling surveys to assess CPUE rates and to collect water temperature measurements. Once these data are collected, the potential relative abundance of sea turtles (primarily loggerheads) within the channel may be assessed.

Low sea turtle relative abundance was seen primarily during the winter months when water temperatures were ≤ 16 °C. High sea turtle relative abundance was documented during summer and early fall when water temperatures were high. As a tool for resource managers, these extremes are easy to interpret and utilize to determine time of the year when hopper dredging activities should or should not be implemented. Those CPUE rates and water temperature combinations which may be designated as a medium or moderate level of sea turtle relative abundance were primarily seen during early spring and late fall. This assessment of potential sea turtle occurrence is the most difficult to use by the resource manager; therefore, additional factors such as channel

As a conservative and precautionary measure, moderate to high sea turtle abundance may be expected when water temperature is ≥ 21 °C; however, this may not be a correct assessment for channels with very low CPUE rates. Channel location and previously documented physical and biological data should also be considered if the trawl survey yields a very low CPUE even at high water temperature. This can be illustrated using the September 1992 (CPUE turtles/hour = 0; mean water temperature = 27.7 °C) data from Charleston Harbor. Although no turtles were captured during this survey, a high relative abundance of sea turtles apparently were within the channel during the September 1992 survey based on trawling surveys conducted during July 1992 (CPUE turtles/hour = 0.490; mean water temperature = 26.6 °C) and October 1992 (CPUE turtles/hour = 1.067; mean water temperature = 21.3 °C). Van Dolah and Maier (1993) also documented sea turtle presence in Charleston Harbor during September 1990 and 1991. It is unclear why no turtles were captured during the September 1992 trawl survey in this study.

Due to the inherent limitations of surveys conducted with bottom trawling techniques, the assessments of potential sea turtle relative abundance using CPUE rates and water temperature would best reflect the occurrence of sea turtles on or near the channel bottom. This is also the area of most concern for potential dredging impacts to sea turtles.

6 Summary

A total of 76 monthly trawling surveys were conducted for sea turtle relative abundance from June 1991 through March 1993 in the Canaveral Harbor entrance channel, Florida (12 surveys), Fernandina Harbor St. Marys River entrance channel (Kings Bay), Florida (14 surveys), Brunswick Harbor ocean bar channel, Georgia (9 surveys), Savannah Harbor ocean bar channel, Georgia (17 surveys), Charleston Harbor entrance channel, South Carolina (11 surveys), and Morehead City Harbor entrance channel, North Carolina (13 surveys).

A combined total of 645 loggerheads (*Caretta caretta*), 20 Kemp's ridley (*Lepidochelys kempi*), and 5 green turtles (*Chelonia mydas*) were captured. Loggerheads were consistently the most abundant species in all six channels. Although only a very low number of Kemp's ridleys were captured during this study, the majority were captured at Fernandina and Brunswick Harbors. No quantitative conclusions can be made from the low sample size of green turtle captures.

Kemp's ridley and green turtles did not appear to utilize the deeper dredged areas of the channels. Although not investigated in this study, the shallower areas outside the channels may serve as an important habitat to Kemp's ridley and green turtles. The dredged sections of the channels which were not surveyed because of rock substrate and debris (such as near rock jetties) may also be inhabited by very small loggerheads, Kemp's ridley, and green turtles. Further studies are needed in these locations using alternative sampling techniques.

Catch per unit effort was calculated as indices to compare spatial and temporal sea turtle abundance within and between the six channels.

Juvenile loggerheads 50-70 cm in length were the predominant size-classes in the five channels north of Canaveral Harbor. Very few adult loggerheads were present in the deeper dredged section of these channels. Both adult and juvenile loggerhead size-classes utilized the deeper dredged section of Canaveral Harbor; however, differences in seasonal occurrence were seen.

For the five channels surveyed north of Canaveral Harbor, loggerhead (primarily juveniles) captures began in late spring (April, May), increased throughout summer (June, July, August), peaked in fall (September, October,

November), then dramatically declined during winter (December, January, February). Peak month for loggerhead captures in these channels appeared to be October. In Canaveral Harbor, adults were primarily present during late spring through summer whereas peak occurrence for juveniles was midwinter (January).

Spatial (station) distribution was not random. A significantly higher number of turtles were captured in at least one of the sampling stations within all surveyed channels except Morehead City Harbor. However, no conclusions can be determined without further investigation into factors which may influence sea turtle behavior such as bottom topography, substrate, depth, food organisms, etc.

Recaptures of sea turtles throughout this 21-month study suggest month to month and year-to-year site fidelity of some individuals. Recaptures of turtles tagged between multiple channels suggest channel utilization during migratory activities.

The success of relocation efforts is difficult to evaluate; however, relocation of turtles out of the dredging area may be most feasible when there are low densities of turtles. Trawling operations used to relocate turtles may have increased success if begun shortly before or at least at the onset of the dredging operation and not during the latter portion of the project. Turtle relocation operations are limited to areas in the channels where trawling is possible; however, trawling should be done throughout as much of the channel as possible.

For the five channels surveyed north of Canaveral Harbor, very few sea turtles were captured when water temperatures were at or below 16 °C. Although the lower critical temperature limits may be different for each species and size-class, temperatures below 16 °C may be used as a conservative indicator of time periods in these channels which have reduced sea turtle occurrence or activities. The relationship between sea turtle occurrence and water temperature was not seen at Canaveral Harbor as was shown in the other channels surveyed.

7 Conclusions and Recommendations

This study has helped to define water temperature as a critical factor in sea turtle occurrence for Fernandina, Brunswick, Savannah, Charleston, and Morehead City Harbors. This work has only begun to identify the spatial and temporal utilization patterns of sea turtles in the hopper dredged channels. Water temperature may serve as a fundamental tool for assessing potential sea turtle occurrence; however, dredging windows should not be based solely on temperature data alone. Additional consideration should be given to historical data on channel utilization by sea turtles. Based on the results of this study, the South Atlantic coast might be divided into the following regions based on differences in species composition and relative abundance: North Carolina, South Carolina, Georgia-North Florida, and Canaveral Harbor. These designated regions may warrant more individualized dredging restrictions during future hopper dredging projects to better reflect the differences in sea turtle occurrence.

Further work is critically needed to confirm the trends identified in this study and understand these complex pelagic creatures. Recognizing the limitations of trawling as a surveying tool, this information can best be gathered through additional trawling surveys in combination with biotelemetry studies. Long-term relative abundance, behavioral, physiological, and nutritional data would provide more reliable predictors of sea turtle activity within a designated area. Because it has been demonstrated that sea turtle population levels can change, populations must be periodically surveyed to update their status and potential for negative impacts from dredging.

References

- Bolten, A., and Bjorndal, K. (1988). "Survey of sea turtles in Cape Canaveral Channel." Unpublished 1988 survey reports to National Marine Fisheries Service, St. Petersburg, FL.
- _____. (1991). "Relocation of sea turtles during dredging at Cape Canaveral, FL, 30 December 1990-15 January 1991," Archie Carr Center for Sea Turtle Research - University of Florida, USAE Cooperative Agreement DACW17-90-H-0015.
- Bolten, A. B., Bjorndal, K. A., Eliazar, P. J., and Gregory, L. F. (1993). "Assessment of sea turtle relative abundance in Port Canaveral Ship Channel, Florida," Project Report for U.S. Army Corps of Engineers Waterways Experiment Station, Contract No. DACW17-90-H-0015.
- Bullis, H. R., Jr., and Drummond, S. B. (1978). "Sea turtle captures off the southeastern United States by exploratory fishing vessels 1950-1976. Proceedings, Florida and Interregional Conference on Sea Turtles, 24-25 July, Jensen Beach, Florida," *Fla. Mar. Res. Pub.* 33, 45-50.
- Butler, R. W., Nelson, W. A., and Henwood, T. A. (1987). "A trawl survey method for estimating loggerhead turtle, *Caretta caretta*, abundance in five eastern Florida channels and inlets," *Fishery Bulletin* 85(3), 447-53.
- Byles, R. A. (1988). "The behavior and ecology of sea turtles in Virginia," Ph.D. diss., Virginia Inst. Mar. Sci., College of William and Mary, Gloucester Point, VA.
- Carr, A. F., Jr. (1952). *Handbook of turtles. The turtles of the United States, Canada, and Baja California*. Cornell University Press, Ithaca, NY.
- Carr, A. F., Jr., Ogren, L., and McVea, C. (1980). "Apparent hibernation by the Atlantic loggerhead turtle *Caretta caretta* off Cape Canaveral, Florida," *Bull. Conserv.* 19, 7-14.
- Clifton, K., Cornejo, D. C., and Felger, R. S. (1982). "Sea turtles of the Pacific Coast of Mexico." *Biology and Conservation of Sea Turtles*. K. A. Bjorndal, ed., Smithsonian Institution Press, Washington, DC, 199-209.

- Crouse, D. T., Crowder, L. B., and Caswell, H. (1987). "A stage-based population model for loggerhead sea turtles and implications for conservation," *Ecology* 68, 1412-23.
- Dickerson, D. D., and Nelson, D. A. (1990). "Proceedings of the national workshop on methods to minimize dredging impacts on sea turtles, 11 and 12 May 1988, Jacksonville, Florida," Miscellaneous Paper EL-90-5, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Dickerson, D. D., Nelson, D. A., and Banks, G. (1990). "Alternative dredging equipment and operational methods to minimize sea turtle mortalities," *Environmental Effects of Dredging Technical Notes*, EEDP-09-6, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Dickerson, D. D., Nelson, D. A., Dickerson, C. E., Jr., and Reine, K. J. (1993). "Dredging related sea turtle studies along the southeastern U.S.," *Coastal Zone 93*, New Orleans, LA, 6-17.
- Dickerson, D. D., Richardson, J. I., Ferris, J. S., Bass, A. L., and Wolff, M. (1991). "Entrainment of sea turtles by hopper dredges in Cape Canaveral and Kings Bay ship channels," *Environmental Effects of Dredging*, Vol D-91-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Ehrhart, L. M. (1983). "Marine turtles of the Indian River Lagoon System," *Fla. Sci.* 46, 337-46.
- Felger, R. S., Clifton, K., and Regal, P. J. (1976). "Winter dormancy in sea turtles: Independent discovery and exploitation in the Gulf of California by two local cultures," *Science* 191, 283-5.
- Fritts, T. H., Irvine, A. B., Jennings, R. D., Collum, L. A., Hoffman, W., and McGehee, M. A. (1983). "Turtles, birds, and mammals in the northern Gulf of Mexico and nearby Atlantic waters," Fish and Wildlife Service, U.S. Department of the Interior. Washington, DC, FWS/OBS-82/65.
- Henwood, T. A. (1987). "Movements and seasonal changes in loggerhead turtle *Caretta caretta* aggregations in the vicinity of Cape Canaveral, Florida (1978-84)," *Biological Conservation* 40, 191-202.
- Henwood, T. A., and Ogren, L. H. (1987). "Distribution and migrations of immature Kemp's ridley turtles (*Lepidochelys kempi*) and green turtles (*Chelonia mydas*) off Florida, Georgia, and South Carolina," *Northeast Gulf Science* 9, 153-9.
- Joyce, J. C. (1982). "Protecting sea turtles," *The Military Engineer*, No. 481, July-August, 282-5.

- Keinath, J. A., Musick, J. A., and Byles, R. A. (1987). "Aspects of the biology of Virginia's sea turtles: 1979-1986," *Virginia Journal of Science*. 38(4), 329-36.
- Landry, A. M., Jr., Costa, D. T., Coyne, M. S., St. John, K., and Williams, B. (1993). "Sea turtle capture and habitat characterization: South Padre Island and Sabine Pass, Texas environs," Project Report for U.S. Army Corps of Engineers, Galveston District. Contract No. 92-206.
- Lutz, P. L. (1990). "Sea turtle hibernation in the Cape Canaveral ship channel." Proceedings, National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles, 11-12 May 1988, Jacksonville, Florida. D. D. Dickerson and D. A. Nelson, compilers, Miscellaneous Paper EL-90-5, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Mendonca, M. T. (1983). "Movements and feeding ecology of immature green turtles (*Chelonia mydas*) in a Florida lagoon," *Copeia* (4), 1013-23.
- Mendonca, M. T., and Ehrhart, L. M. (1982). "Activity, population size and structure of immature *Chelonia mydas* and *Caretta caretta* in Mosquito Lagoon, Florida," *Copeia* 1, 161-7.
- NMFS Regional Biological Opinion. (1991). "Dredging of channels in the southeastern United States from North Carolina through Cape Canaveral, Florida," Southeast Regional Office, St. Petersburg, FL.
- National Research Council. (1990). *Decline of the Sea Turtles: Causes and Prevention*. National Academy Press, Washington, DC.
- Nelson, D., Dickerson, D., Berry, S., and Moulding, J. (1989). "Methods to minimize dredging impacts on sea turtles," Twelfth World Dredging Congress, 2-5 May 1989, Orlando FL, 973-82.
- Ott, L. (1988). *An introduction to statistical methods and data analysis*. 3rd ed., PWS-Kent Publishing Company, Boston.
- Pritchard, P., Bacon, P., Berry, F., Carr, A., Fletemeyer, J., Gallagher, R., Hopkins, S., Lankford, R., Marquez, R., Ogren, L., Pringle, W., Jr., Reichart, H., and Witham, R. (1983). *Manual of sea turtle research and conservation techniques*. K. A. Bjorndal and G. H. Balazs, ed., 2nd ed., Center for Environmental Education, Washington, DC.
- Renaud, M. L., Carpenter, J. A., Manzella, S.A., and Williams, J. A. (1993). "Telemetric tracking of green sea turtles (*Chelonia mydas*) in relation to dredged channels at South Padre Island, TX," Project Report to U.S. Army Corps of Engineers Galveston District, NMFS Southeast Fisheries Science Center, Galveston, TX.

- Richardson, J. I., and Hillestad, H. O. (1979). "Survey for wintering turtles in South Carolina and Georgia." Final Report to the National Marine Fisheries Service, Miami, FL, under Contract No. 03-78-DO8-0062.
- Richardson, J. I., and Richardson, T. H. (1982). "An experimental population model for the loggerhead sea turtle (*Caretta caretta*)." *Biology and Conservation of Sea Turtles*. K. A. Bjorndal, ed., Smithsonian Institution Press, Washington, DC, 165-74.
- Schroeder, B. A., Ehrhart, L. M., Guseman, J. L., Owen, R. D., and Redfoot, W. E. (1990). "Cold stunning of marine turtles in the Indian River Lagoon System, Florida, December 1989." Proceedings, Tenth Annual Workshop on Sea Turtle Biology and Conservation. T. H. Richardson, J. I. Richardson, and M. Donnelly, Compilers, NOAA Technical Memorandum NMFS-SEFC-278, 67-9.
- Shoop, C., Doty, T., and Bray, N. (1981). "Sea turtles in the region between Cape Hatteras and Nova Scotia in 1979." *A characterization of marine mammals and turtles in the mid- and north-Atlantic areas of the U.S. outer continental shelf: Annual report for 1979*. University of Rhode Island, Kingston, 1-85.
- Standora, E. A., Morreale, S. J., Bolten, A. (1993). "Behavior, daily movements, and homing of loggerhead turtles (*Caretta caretta*) at Cape Canaveral, Florida, March and April 1993," Project Report for U.S. Army Corps of Engineers Waterways Experiment Station, Contract No. DACW39-93-C-0024.
- Standora, E. A., Morreale, S. J., Bolten, A. B., Eberle, M. D., Edbauer, J. M., Ryder, T. S., and Williams, K. L. (1994). "Diving behavior and vertical distribution of loggerheads, and a preliminary assessment of trawling efficiency for censusing." *Proceedings, Thirteenth Annual Symposium on Sea Turtle Biology and Conservation, 23-27 February 1993, Jekyll Island, Georgia*. B. A. Schroeder and B. E. Witherington, Compilers, NOAA Technical Memorandum NMFS-SEFSC-341, 174-7.
- Studt, J. E. (1987). "Amelioration of maintenance dredging impacts on sea turtles, Canaveral Harbor, Florida." *Ecology of East Florida Sea Turtles*. W. N. Witzell, ed., Proceedings of Cape Canaveral, Florida, Sea Turtle Workshop, Feb. 26-27, 1985. NOAA Technical Report NMFS 53, Miami, FL, 55-8.
- Thompson, N. B. (1988). "The status of loggerhead, *Caretta caretta*, Kemp's ridley, *Lepidochelys kemp*, and green, *Chelonia mydas*, sea turtles in U.S. waters," *Marine Fisheries Review*, 50(3), 16-23.

- Van Dolah, R. F., and Maier, P. P. (1993). "The distribution of loggerhead turtles (*Caretta caretta*) in the entrance channel of Charleston Harbor, South Carolina, U.S.A.," *Journal of Coastal Research* 9(4), 1004-12.
- Van Dolah, R. F., Maier, P. P., Hopkins-Murphy, S. R., Ulrich, G. F., and Cupka, D. M. (1992). "A survey of turtle populations in the Charleston Harbor entrance channel." Final Report prepared by Marine Resources Division, South Carolina Wildlife and Marine Resources Department for U.S. Department of Interior U.S. Fish and Wildlife Service. Charleston, South Carolina. Agreement No. 14-16-0004-90-944.
- Wilcox, W. A. (1986). "Commercial fisheries of the Indian River, Florida," *Rept. U.S. Comm. Fish.* 22, 249-62.
- Witherington, B. E. (1986). "Human and natural causes of marine turtle clutch and hatchling mortality and their relationship to hatchling production on an important Florida nesting beach," M.S. thesis, University of Central Florida, Orlando.
- Witherington, B. E., and Ehrhart, L. M. (1989). "Hypothermic stunning and mortality of marine turtles in the Indian River Lagoon system, Florida, U.S.A.," *Copeia* 1989 (3), 696-703.

Table 1
Summary of South Atlantic Hopper Dredging Projects with Documented Sea Turtle Incidents (1980-1994)

Date	Amount Dredged (Cubic Yards)	Vessel(s)	Total Sea Turtle Incidents
Canaveral Harbor, Florida			
1980 11 Jul-30 Nov	1,400,000	<i>Long Island</i> <i>Dodge Island</i> <i>Sugar Island</i>	71
1981 13 Aug-22 Sep	257,400	<i>McFarland</i>	6
1983 ? Feb- ? May	609,000 (Inside jetties)	<i>McFarland</i> <i>Sugar Island</i>	NA
? Aug- ? Dec	914,000 (Seaward of dogleg)	<i>McFarland</i>	NA
1984 26 Nov-18 Dec	2,700,000	<i>Sugar Island</i> <i>McFarland</i>	12
1985 15 Jan-31 Jan	370,000	<i>McFarland</i>	0
1986 2 Sep-6 Oct	350,000	<i>Ouachita</i>	5
1988 24 Aug-21 Oct	1,408,000	<i>Dodge Island</i> <i>Atchafalaya</i> <i>Mermentau</i>	34
1989/1990 6 Dec-16 Jan	290,000	<i>McFarland</i>	11
1990/1991 14 Dec-18 Jan	212,848	<i>Sugar Island</i>	8
FY 92/93 - No hopper dredging was performed.			
Fernandina Harbor (Kings Bay), Florida			
1986 May	250,000	<i>Sugar Island</i>	4
1987 15 Jul-31 Dec	910,000	<i>Eagle I</i> <i>Manhattan Is.</i> <i>Jim Bean</i> <i>Sugar Island</i>	5
1988 1 Jan-24 Jul/31 Oct-9 Dec	5,456,000	<i>Eagle I</i> <i>Sugar Island</i> <i>Dodge Island</i> <i>Manhattan Is.</i> <i>Mermentau</i> <i>Atchafalaya</i> <i>Ouachita</i>	11
1989 31 May-11 Jun	152,000	<i>McFarland</i>	3
11 Nov-18 Dec	720,000	<i>Atlantic</i> <i>American</i>	6
1990 23 Oct-13 Dec	754,000	<i>Sugar Island</i>	4
(Continued)			

Table 1 (Concluded)

Date	Amount Dredged (Cubic Yards)	Vessel(s)	Total Sea Turtle Incidents
Fernandina Harbor (Kings Bay), Florida (Continued)			
1991 24 Jan-23 Mar	766,685	<i>Sugar Island</i>	1
1991/1992 18 Dec-12 Feb	640,237	<i>McFarland</i>	0
1992 6 Feb-5 Mar	229,336	<i>Eagle I</i>	0
1993 18 Jan-13 Feb	253,585	<i>McFarland</i>	0
1994 3 Dec 93-15 Jan 94 3-20 Mar 94	419,060 350,550	<i>McFarland</i> <i>Ouachita</i>	1 1
Charleston Harbor, South Carolina			
1991 1 Aug-14 Apr	3,030,000	<i>Sugar Island</i> <i>Dodge Island</i>	3
Port Royal Harbor, South Carolina			
1992 16 Feb-29 Mar	700,000	<i>Padre Island</i>	2
Ft. Pierce Inlet, Florida			
1994 6 Nov 93-28 Jan 94	62,000	<i>Sugar Island</i>	1
Morehead City Harbor, North Carolina			
1994 23 Nov 93-3 Apr 94	2,900,000	<i>Ouachita</i> <i>Mermentau</i> <i>Eagle I</i>	1
Brunswick Harbor, Georgia			
1988 Jun - Aug	907,673	<i>Dodge Island</i> <i>Manhattan Is.</i>	1
1989 Oct - Nov	1,027,400	<i>Eagle I</i>	0
1991 23 Mar-20 Jun	1,583,000	<i>Sugar Island</i> <i>Dodge Island</i>	22
1993 15 Jan-8 Apr	1,472,239	<i>Atchafalaya</i> <i>Ouachita</i> <i>Mermentau</i>	0
Savannah Harbor, Georgia			
1989 Nov - Dec	648,948	<i>Eagle I</i>	1
1991 20 Jun-14 Aug	1,104,991	<i>Sugar Island</i> <i>Dodge Island</i>	17
1992 1-23 Dec	554,707	<i>Eagle I</i> <i>Ouachita</i>	1
1994 13 Dec 93 - 24 Mar 94	2,825,926	<i>R. N. Weeks</i> <i>Ouachita</i>	2 2

Table 2
Reported Sea Turtle Entrainment Incidents by Species During South Atlantic Hopper Dredging Activities (1980-1994)

Year	<i>C. caretta</i>		<i>L. kempi</i>		<i>C. mydas</i>		Unidentified ¹	Total	
	Dead	Live/Injured	Dead	Live/Injured	Dead	Live/Injured		Dead	Live/Injured
Canaveral Harbor, Florida									
1980	50	-	-	-	-	3	18	68	3
1981	3	-	-	-	-	1	2	5	1
1984/85	1	-	-	-	-	-	11	12	-
1986	3	2	-	-	-	-	-	3	2
1988	12	1	-	-	2	1	18	32	2
1989/90	-	-	-	-	6	3	2	8	3
1990/91	2	1	-	-	2	3	-	4	4
Total	71	4	0	0	10	11	51	132	15
Fernandina Harbor (Kings Bay), Florida									
1986	1	-	-	-	-	3	-	1	3
1987	3	-	-	-	1	-	1	5	-
1988	6	-	3	-	1	1	-	10	1
1989	8	-	-	-	1	-	-	9	-
1990	4	-	-	-	-	-	-	4	-
1991	1	-	-	-	-	-	-	1	-
1994	2	-	-	-	-	-	-	2	-
Total	25	0	3	0	3	4	1	32	4
Brunswick Harbor, Georgia									
1988	1	-	-	-	-	-	-	1	-
1989	-	-	-	-	-	-	-	-	-
1991	18	2	1	-	-	-	1	20	2
Total	19	2	1	0	0	0	1	21	2
Savannah Harbor, Georgia									
1989	1	-	-	-	-	-	-	1	-
1991	16	1	-	-	-	-	-	16	1
1992	1	-	-	-	-	-	-	1	-
1994	2	1	-	1	-	-	-	2	2
Total	20	2	0	1	0	0	0	20	3
Charleston Harbor, South Carolina									
1991	3	0	0	0	0	0	0	3	0

(Continued)

¹ Fragments of sea turtle carcasses not identified to species. Most assumed to be *C. caretta*.

Table 2 (Concluded)

Year	<i>C. caretta</i>		<i>L. kempi</i>		<i>C. mydas</i>		Unidentified ¹	Total	
	Dead	Live/Injured	Dead	Live/Injured	Dead	Live/Injured		Dead	Live/Injured
Port Royal Harbor, South Carolina									
1992	2	0	0	0	0	0	0	2	0
Fort Pierce Inlet, Florida									
1994	0	0	0	0	1	0	0	1	0
Morehead City Harbor, North Carolina									
1994	1	0	0	0	0	0	0	1	0
Channels Combined									
1980-1994	141	8	4	1	14	15	53	212	24

Table 3
Sampling Stations for Surveyed Southeastern U.S. Hopper Dredged
Channels

Channel	Loran							
	Station 1 (Inshore)		Station 2		Station 3		Station 4 (Offshore)	
	East Point	West Point	East Point	West Point	East Point	West Point	East Point	West Point
Canaveral	43970.7 62037.1	43957.2 62028.5	43957.2 62028.5	43939.5 62022.1	43939.5 62022.1	43921.0 62015.0	43921.0 62015.0	43901.7 62007.7
Fernandina	45415.5 61987.0	45403.0 61970.0	45403.0 61970.0	45388.0 61953.0	45388.0 61953.0	45377.5 61936.0	45377.5 61936.0	45361.0 61922.5
Savannah	45642.8 61298.0	45628.8 61285.5	45628.8 61285.5	45614.5 61281.5	45614.5 61281.5	45599.3 61271.1	45599.3 61271.1	45585.6 61260.0
Charleston	45497.8 60501.6	45486.6 60491.3	45486.6 60491.3	45475.4 60481.2	45475.4 60481.2	45464.3 60471.2	*	*
Morehead	345130 764009	344007 764132	344007 764132	343107 764052	*	*	*	*

* No sampling stations.

Note: Sampling stations were not used in Brunswick Harbor until the predredge survey in December 1992.

Table 4**Distribution of Trawling Dates for Southeastern U.S. Hopper Dredged Channels Surveyed From June 1991 Through March 1993**

Month	Canaveral	Fernandina	Brunswick	Savannah	Charleston	Morehead
Jun 91	*	*	24 May-20 Jun (R)	22-26 Jun (R)	*	*
Jul 91	*	*	*	*	*	*
Aug 91	*	*	*	1-14 Aug (R)	21-22 Aug (P)	*
Sep 91	*	*	29 Sep-3 Oct	*	7 Sep- 1 Oct (P)	*
Oct 91	*	8-10 Oct (P)	25-29 Oct	3-7 Oct	*	*
Nov 91	*	*	*	30 Oct-3 Nov	*	*
Dec 91	*	10-22 Dec (R) 30 Dec-9 Jan	2-6 Dec	7-11 Dec	*	6-10 Dec (P)
Jan 92	*	*	2-6 Jan	7-11 Jan	*	*
Feb 92	*	*	9-14 Feb	2-6 Feb	*	*
Mar 92	6-8 Mar	25-26 Mar	7-11 Mar	3-5 Mar	28 Mar-1 Apr (R)	31 Mar-1 Apr
Apr 92	13-16 Apr	*	6-10 Apr	3-5 Apr	8-9 Apr	29-30 Apr
May 92	12-14 May	5-8 May	*	1-2 May	28-30 Apr	27-28 May
Jun 92	17-19 Jun	15-16 Jun	*	*	13-14 Jun	25-26 Jun
Jul 92	8-10 Jul	20-21 Jul	*	4-5 Jul	7-8 Jul	31 Jul
Aug 92	11-13 Aug	17-18 Aug	*	*	*	26 Aug
Sep 92	2-4 Sep	21-22 Sep	*	4-5 Sep	2-3 Oct	30 Sep-1 Oct
Oct 92	13-15 Oct	20-21 Oct	*	9-10 Oct	8-9 Oct	12 Oct
Nov 92	13-15 Nov	18-19 Nov	*	5-6 Nov	2-3 Nov	4 Nov
Dec 92	9-11 Dec	17-18 Dec	19-21 Dec (P)	28-29 Dec	30 Nov-1 Dec	30 Nov
Jan 93	22-24 Jan	13-14 Jan	*	4-5 Jan	*	15 Jan
Feb 93	19-21 Feb	17-18 Feb	*	*	*	3 Mar
Mar 93	*	29-30 Mar	*	4-5 Mar	*	*

Note: * = No monthly survey; P = Predredged survey; R = Relocation survey. Shaded area reflects standardized distance trawling protocol, whereas unshaded area reflects standardized time trawling protocol.

Table 5
Distribution of Channel Length and Width, Number of Stations
and Trawls per Stations, and Total Number of Paired Trawls for
Surveyed Channels

Channel	Channel Length nm (km)	Channel Width m (ft)	Number of Stations	Number of Trawls Per Station	Total Paired Trawls Per Month
Canaveral	5.0 (9.3)	120 (400)	4	6	24
Ferlandina	8.3 (15.4)	150 (500)	4	7	28
Brunswick ¹	5.0 (9.3)	150 (500)	5	7	35
Savannah	6.6 (12.2)	180 (600)	4	8	32
Charleston	22.9 (42.4)	150-210 (500-700)	3	7-10	28
Morehead	2.4 (4.4)	140 (450)	2	10 ²	20

¹ Sampling stations were not used at Brunswick Harbor until December 1992.

² Additional trawls were conducted in Morehead City Harbor to secure a contractor.

Table 6
Distribution of Total Number of Trawls Conducted Within Southeastern
U.S. Hopper Dredged Channels Surveyed From June 1991 Through March
1993

Month	Canaveral	Fernandina	Brunswick	Savannah	Charleston	Morehead
Jun 91	*	*	170	33	*	*
Jul 91	*	*	*	*	*	*
Aug 91	*	*	*	138	17	*
Sep 91	*	*	58	*	269	*
Oct 91	*	20	67	48	*	*
Nov 91	*	*	*	56	*	*
Dec 91	*	202	58	64	*	54
Jan 92	*	*	61	67	*	*
Feb 92	*	*	51	52	*	*
Mar 92	24	28	53	59	30	20
Apr 92	24	*	63	33	25	24
May 92	24	29	*	33	27	21
Jun 92	24	28	*	*	28	18
Jul 92	24	28	*	32	27	21
Aug 92	24	28	*	*	*	20
Sep 92	24	28	*	32	27	20
Oct 92	24	28	*	30	21	20
Nov 92	24	28	*	32	26	20
Dec 92	24	28	35	32	27	20
Jan 93	24	28	*	32	*	20
Feb 93	24	27	*	*	*	20
Mar 93	*	28	*	32	*	*
Total	288	558	616	805	524	296

* No monthly survey.

Note: Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 7
Distribution of Mean Trawl Distance (nm) for Southeastern U.S. Channels
Surveyed From June 1991 Through March 1993

Month	Canaveral	Fernandina	Brunswick	Savannah	Charleston	Morehead
Jun 91	*	*	2.19	2.27	*	*
Jul 91	*	*	*	*	*	*
Aug 91	*	*	*	1.57	1.487	*
Sep 91	*	*	1.40	*	1.505	*
Oct 91	*	1.535	1.45	1.52	*	*
Nov 91	*	*	*	1.46	*	*
Dec 91	*	1.581	1.36	1.51	*	1.428
Jan 92	*	*	1.50	1.42	*	*
Feb 92	*	*	1.40	1.58	*	*
Mar 92	1.1	1.576	1.37	1.46	1.194	1.223
Apr 92	1.08	*	1.37	1.24	0.9794	1.211
May 92	1.083	1.128	*	1.17	1.166	1.099
Jun 92	1.079	1.092	*	*	0.9668	1.047
Jul 92	1.081	1.122	*	1.08	1.075	1.079
Aug 92	1.058	1.224	*	*	*	1.128
Sep 92	1.047	1.146	*	1.09	1.028	1.09
Oct 92	1.065	1.15	*	1.09	1.023	1.182
Nov 92	1.082	1.11	*	1.08	1.00	1.135
Dec 92	1.09	1.12	1.09	1.01	1.03	1.127
Jan 93	1.075	1.087	*	1.00	*	1.09
Feb 93	1.08	1.099	*	*	*	1.08
Mar 93	*	1.085	*	1.08	*	*

* No monthly survey.

Note: Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 8
Distribution of Total Trawl Distance (nm) for Southeastern U.S. Hopper
Dredged Channels Surveyed From June 1991 Through March 1993

Month	Canaveral	Fernandina	Brunswick	Savannah	Charleston	Morehead
Jun 91	*	*	372.48	74.75	*	*
Jul 91	*	*	*	*	*	*
Aug 91	*	*	*	216.34	25.28	*
Sep 91	*	*	81.12	*	405.03	*
Oct 91	*	32.7	97.03	72.89	*	*
Nov 91	*	*	*	81.95	*	*
Dec 91	*	319.46	79.13	96.47	*	77.12
Jan 92	*	*	91.68	95.32	*	*
Feb 92	*	*	71.53	82.08	*	*
Mar 92	26.40	44.13	72.72	85.86	35.83	24.46
Apr 92	26.92	*	86.14	40.79	24.48	26.9
May 92	25.99	32.7	*	38.59	31.47	23.07
Jun 92	25.90	30.57	*	*	27.07	16.74
Jul 92	25.94	31.41	*	34.52	29.05	22.66
Aug 92	25.4	34.28	*	*	*	22.57
Sep 92	25.12	32.09	*	34.72	27.75	21.8
Oct 92	25.57	32.19	*	32.54	21.47	23.64
Nov 92	25.97	31.20	*	34.40	25.99	22.71
Dec 92	26.13	31.45	38.09	32.34	27.71	22.56
Jan 93	25.80	30.72	*	32.11	*	21.96
Feb 93	25.98	29.69	*	*	*	21.61
Mar 93	*	30.37	*	34.44	*	*
Total	910.12	742.96	989.92	1,120.11	681.13	347.8

* No monthly survey.

Note: Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 9
Distribution of Mean Trawl Time (min) for Southeastern U.S. Hopper Dredged Channels Surveyed From June 1991 Through March 1993

Month	Canaveral	Fernandina	Brunswick	Savannah	Charleston	Morehead
Jun 91	*	*	40.27	45.03	*	*
Jul 91	*	*	*	*	*	*
Aug 91	*	*	*	29.54	29.71	*
Sep 91	*	*	29.41	*	29.53	*
Oct 91	*	29.15	30.03	31.00	*	*
Nov 91	*	*	*	30.11	*	*
Dec 91	*	29.74	28.69	30.20	*	27.1
Jan 92	*	*	29.79	28.97	*	*
Feb 92	*	*	30.08	30.42	*	*
Mar 92	24.0	30.04	29.47	29.92	22.8	26.25
Apr 92	25.13	*	28.11	21.52	23.16	22.86
May 92	24.29	23.31	*	21.15	25.0	24.19
Jun 92	25.46	20.214	*	*	20.5	21.86
Jul 92	24.21	21.464	*	18.63	22.67	21.1
Aug 92	23.71	20.464	*	*	*	20.4
Sep 92	25.42	20.286	*	22.28	20.44	20.6
Oct 92	25.88	21.464	*	19.43	21.43	21.55
Nov 92	27.25	20.89	*	20.38	19.92	20.85
Dec 92	27.25	21.86	20.5	20.16	21.07	22.4
Jan 93	26.42	20.68	*	20.38	*	22.3
Feb 93	26.75	21.56	*	*	*	22.62
Mar 93	*	21.71	*	18.86	*	*

* No monthly survey.

Note: Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 10

Distribution of Total Trawl Time (min) for Southeastern U.S. Hopper Dredged Channels Surveyed From June 1991 Through March 1993

Month	Canaveral	Fernandina	Brunswick	Savannah	Charleston	Morehead
Jun 91	*	*	6,846	1,486	*	*
Jul 91	*	*	*	*	*	*
Aug 91	*	*	*	4,077	505	*
Sep 91	*	*	1,706	*	7,944	*
Oct 91	*	583	2,012	1,488	*	*
Nov 91	*	*	*	1,686	*	*
Dec 91	*	6,008	1,664	1,933	*	1,620
Jan 92	*	*	1,817	1,941	*	*
Feb 92	*	*	1,534	1,582	*	*
Mar 92	576	841	1,562	1,765	684	542
Apr 92	603	*	1,771	710	579	630
May 92	583	676	*	698	675	480
Jun 92	611	566	*	*	574	387
Jul 92	581	601	*	596	612	459
Aug 92	569	573	*	*	*	422
Sep 92	610	566	*	713	552	408
Oct 92	621	601	*	583	450	412
Nov 92	654	585	*	652	518	431
Dec 92	654	612	716	645	569	417
Jan 93	634	579	*	652	*	448
Feb 93	642	582	*	*	*	446
Mar 93	*	608	*	604	*	*
Total	7,338	13,983	19,628	21,811	13,662	7,102

* No monthly survey.

Note: Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 11
Distribution of Sea Turtles Captured in Port and Starboard Nets
for Southeastern U.S. Hopper Dredged Channels Surveyed From
June 1991 Through March 1993

Channel	Starboard Net	Port Net	Total Turtles
Canaveral	95	80	175
Fernandina	70	63	133
Brunswick	75	85	160
Savannah	70	82	152
Charleston	22	25	47
Morehead City	3	0	3
Total	335	335	670

Table 12

Distribution of Turtles Captured, Hours Trawled, and CPUE (turtles/hour) by Tidal Stage for Surveyed Southeastern U.S. Hopper Dredged Channels

Channel	Tidal Stage						Total	
	Ebb	Slack		Flood				
Number of Turtles Captured and Hours Trawled								
Fernandina	55	102.9	18	38.8	60	91.4	133	233.1
Brunswick	68	142.9	23	47.7	69	136.5	160	327.1
Savannah	57	153.4	31	66.3	64	143.8	152	363.5
Charleston	22	67.4	9	46.5	16	113.8	47	227.7
Morehead City	2	50.01	1	22.83	0	45.6	3	118.4
Total	204	516.6	82	222.1	209	531.1	495	1,269.8
CPUE (Turtles/Hour)								
Fernandina	0.53		0.464		0.656		0.571	
Brunswick	0.48		0.48		0.51		0.489	
Savannah	0.372		0.468		0.445		0.418	
Charleston	0.326		0.194		0.141		0.206	
Morehead City	0.04		0.044		0		0.025	
Total	0.395		0.369		0.394		0.390	

Note: Canaveral Harbor not included due to weak or nonexistent tidal flow. Shaded area equals number of hours trawled, while unshaded area equals number of turtles captured.

Table 13
Distribution of Total Number of Turtles Captured, Hours Trawled, and CPUE
(turtles/hour) for Surveyed Southeastern U.S. Hopper Dredged Channels

Channel	Total Turtles	Total Cc	Total Juv. Cc	Total Adult Cc	Total Kemp's Ridleys	Total Green	Total Trawl Hours	CPUE Turt/Hour
Canaveral	175	167 ¹ (5)	85	83	1	2	122.3	1.43
Fernandina	133	123 ¹ (1)	117	7	8	1	233.1	0.570
Brunswick	160	149 ¹ (1)	138	12	9	1	327.1	0.490
Savannah	152	145 ¹ (6)	135	12	1	0	363.5	0.420
Charleston	47	45	41	4	1	1	227.7	0.210
Morehead	3	3	3	0	0	0	118.4	0.025
Total	670	632 ¹ (13)	519	118	20	5	1,392.1	--

¹ Indicates turtles captured (number in parentheses) with no SCL measurement recorded.

Note: Loggerheads (Cc) with maximum SCL less than 82.5 cm were designated as juveniles.

Table 14

Distribution of Total Number of Turtles Captured (Kemp's, Loggerheads, and Greens), Number of Channels Surveyed Monthly, and Distribution of Adult and Juvenile Status for Surveyed Southeastern U.S. Hopper Dredged Channels

Month	# of Channels Surveyed	Total Turtles	Total Cc	Total Juvenile Cc	Total Adult Cc	Total Kemps	Total Green
Jun 91	2	80	78	70	8	2	0
Aug 91	2	27	26 ¹ (1)	25	1	0	0
Sep 91	2	38	35	31	4	3	0
Oct 91	3	104	98 ¹ (3)	97	3	3	0
Nov 91	1	31	30	28	2	1	0
Dec 91	4	56	51	47	4	4	1
Jan 92	2	0	0	0	0	0	0
Feb 92	2	0	0	0	0	0	0
Mar 92	6	23	19	16	3	2	2
Apr 92	5	43	40 ¹ (1)	22	19	1	1
May 92	5	33	33	17	16	0	0
Jun 92	4	42	37 ¹ (3)	12	25	1	1
Jul 92	5	35	35	17	17	0	0
Aug 92	3	18	18	15	3	0	0
Sep 92	5	22	20 ¹ (1)	17	3	1	0
Oct 92	5	46	46	40	6	0	0
Nov 92	5	31	27 ¹ (3)	28	2	1	0
Dec 92	6	10	10	10	0	0	0
Jan 93	4	21	20	20	0	1	0
Feb 93	3	8	7 ¹ (1)	6	1	0	0
Mar 93	2	2	2	1	1	0	0
Total	--	670	632 ¹ (13)	519	118	20	5

¹ No carapace measurement recorded.

Note: Loggerheads (Cc) with maximum SCL less than 82.5 cm were designated as juveniles.

Table 15
Distribution of Total Number of Turtles Captured During Monthly Surveys
From Canaveral Harbor Entrance Channel, Florida

Month	Total Turtle All Species	Total Loggerheads	Total Adult Loggerheads Male\Female	Total Juvenile Loggerheads	Total Greens	Total Kemp's
Mar 92	8	8	1\1	6	0	0
Apr 92	30	28 ¹ (1)	17\1	11	1	0
May 92	22	22	12\3	7	0	0
Jun 92	33	29 ¹ (3)	12\1	7	1	0
Jul 92	18	18	1\15	2	0	0
Aug 92	9	9	0\3	6	0	0
Sep 92	3	3	1\0	2	0	0
Oct 92	12	12	1\2	9	0	0
Nov 92	9	9	1\1	7	0	0
Dec 92	2	2	0\0	2	0	0
Jan 93	21	20	0\0	20	0	1
Feb 93	8	7 ¹ (1)	1\0	6	0	0
Total	175	167 ¹ (5)	36\47	85	2	1

¹ Indicates months in which individual turtles (number in parentheses) had no SCL measurement recorded; therefore adult or juvenile status could not be determined.

Note: Juveniles were defined as turtles with maximum SCL less than 82.5 cm. Shaded area reflects standardized distance trawling protocol.

Table 16
Distribution of Total Number of Turtles Captured During Monthly Surveys
From Fernandina Harbor St. Marys River Entrance Channel

Month	Total Turtles (All Species)	Total Loggerheads	Total Adult Loggerheads Male/Female	Total Juvenile Loggerheads	Total Kemp's Ridley
Oct 91	33	31 *** (1)	0/0	32	1
Dec 91	48**	45	2/2	41	2
Mar 92	3	1	0/0	1	2
Apr 92	*	*	*	*	*
May 92	3	3	0/0	3	0
Jun 92	3	2	1/0	1	1
Jul 92	4	4	0/0	4	0
Aug 92	9	9	0/0	9	0
Sep 92	8	7	1/0	6	1
Oct 92	11	11	0/0	11	0
Nov 92	9	8	0/0	8	1
Dec 92	0	0	0/0	0	0
Jan 93	0	0	0/0	0	0
Feb 93	0	0	0/0	0	0
Mar 93	2	2	0/1	1	0
Total	133	123 *** (1)	4/3	117	8
Total (Apr 92 - Mar 93)	49	46	2/1	43	3

* No monthly survey.

** One green turtle was captured during this month.

*** Number, in parentheses, of turtles captured with no SCL measurement recorded.

Note: Juvenile loggerheads were defined as all turtles with a maximum SCL less than 82.5 cm. Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 17
Distribution of Total Number of Turtles Captured During Monthly Surveys
From Brunswick Harbor Ocean Bar Channel, Georgia

Month	Total Turtles All Species	Total Loggerheads	Total Adult Loggerheads Male/Female	Total Juvenile Loggerheads	Total Kemp's Ridley	Total Green
Jun 91	71	69	2/6	61	2	0
Sep 91	22	20	1/1	18	2	0
Oct 91	43	40 ¹ (1)	0/0	41	2	0
Nov 91	*	*	*	*	*	*
Dec 91	4	2	0/0	2	2	0
Jan 92	0	0	0/0	0	0	0
Feb 92	0	0	0/0	0	0	0
Mar 92	9	8	1/0	7	0	1
Apr 92	11	10	1/0	9	1	0
Dec 92	0	0	0/0	0	0	0
Total	160	149 ¹ (1)	5/7	138	9	1

* No monthly survey.

¹ Number, in parentheses, of turtles captured with no SCL measurement recorded.

Note: Juvenile loggerheads were defined as all turtles with a maximum SCL less than 82.5 cm. Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 18
Distribution of Total Number of Turtles Captured During Monthly Surveys
From Savannah Harbor Ocean Bar Channel, Georgia

Month	Turtles (All Species)	Total Loggerheads	Total Adult Loggerheads Male/Female	Total Juvenile Loggerheads	Total Kemp's Ridley
Jun 91	9	9	1/0	8	0
Aug 91	27	26 ¹ (1)	1/0	25	0
Oct 91	28	27 ¹ (1)	0/3	24	0
Nov 91	31	30	0/2	28	1
Dec 91	3	3	0/0	3	0
Jan 92	0	0	0/0	0	0
Feb 92	0	0	0/0	0	0
Mar 92	0	0	0/0	0	0
Apr 92	1	1	0/0	1	0
May 92	3	3	1/0	2	0
Jul 92	7	7	0/1	5	0
Sep 92	11	10 ¹ (1)	0/1	9	0
Oct 92	14	14	0/2	12	0
Nov 92	11	8 ¹ (3)	0/0	11	0
Dec 92	7	7	0/0	7	0
Jan 93	0	0	0/0	0	0
Mar 93	0	0	0/0	0	0
Total	152	145 ¹ (6)	3/9	135	1
Total (Apr 92 - Mar 93)	54	50 ¹ (40)	1/4	47	0

¹ Number, in parentheses, of turtles captured with no SCL measurement recorded.

Note: Juvenile loggerheads were defined as all turtles with a maximum SCL less than 82.5 cm. Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 19
Distribution of Total Number of Turtles Captured During Monthly Surveys
From the Charleston Harbor Entrance Channel, South Carolina

Month	Total Turtles All Species	Total Loggerheads	Total Adult Loggerheads Male/Female	Total Juvenile Loggerheads	Total Green
Aug 91	0	0	0/0	0	0
Sep 91	16	15	2/0	13	1 ¹
Mar 92	3	2	0/0	2	1
Apr 92	1	1	0/0	1	0
May 92	5	5	0/0	5	0
Jun 92	6	6	2/0	4	0
Jul 92	5	5	0/0	5	0
Aug 92	*	*	*	*	*
Sep 92	0	0	0/0	0	0
Oct 92	8	8	0/0	8	0
Nov 92	2	2	0/0	2	0
Dec 92	1	1	0/0	1	0
Jan 93	*	*	*	*	*
Feb 93	*	*	*	*	*
Mar 93	*	*	*	*	*
Total	47	45	4/0	41	2
Total (Mar 92 - Mar 93)	31	30	2/0	28	1

* No monthly survey.

¹ Kemp's ridley capture.

Note: Juvenile loggerheads were defined as all turtles with a maximum SCL less than 82.5 cm. Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 20**Distribution of Loggerheads Captured for Surveyed Southeastern U.S. Hopper Dredged Channels From June 1991 Through March 1993**

Channel	≤ 40 (cm)	40-50 (cm)	50-60 (cm)	60-70 (cm)	70-80 (cm)	80-90 (cm)	≥ 90 (cm)	Total
Canaveral	0	4	29	34	7	33	60	167 ¹ (5)
Fernandina	0	3	44	52	14	8	2	123 ¹ (1)
Brunswick	0	9	58	56	14	4	8	149 ¹ (1)
Charleston	0	1	19	14	7	2	2	45
Savannah	0	1	59	60	13	8	4	145 ¹ (6)
Morehead	0	1	0	1	1	0	0	3
Total	0	19	209	217	56	55	76	632 ¹ (13)

¹ Number, in parentheses, reflects turtles captured which had no SCL measurement recorded.

Table 21
Size-Class Distribution by Straight Carapace Length (SCL) of Loggerheads
(Cc) Captured During Monthly Surveys From Canaveral Harbor Entrance
Channel, Florida

Month	Total Cc	30-40 (cm)	40-50 (cm)	50-60 (cm)	60-70 (cm)	70-80 (cm)	80-90 (cm)	> 90 (cm)
Mar 92	8	0	1	2	2	0	2	1
Apr 92	28 ¹ (1)	0	0	0	8	0	7	13
May 92	22	0	2	3	1	0	4	12
Jun 92	29 ¹ (3)	0	0	0	1	2	8	18
Jul 92	18	0	0	0	1	1	4	12
Aug 92	9	0	0	3	2	0	2	2
Sep 92	3	0	0	0	1	0	1	1
Oct 92	12	0	0	2	5	2	2	1
Nov 92	9	0	0	3	4	0	2	0
Dec 92	2	0	0	2	0	0	0	0
Jan 93	20	0	1	9	9	1	0	0
Feb 93	7 ¹ (1)	0	0	5	0	1	1	0
Total	167 ¹ (5)	0	4	29	34	7	33	60

¹ Number, in parentheses, of turtles captured with no SCL measurement recorded.

Table 22
Size-Class Distribution by Straight Carapace Length (SCL) of Loggerheads
(Cc) Captured During Monthly Surveys From Fernandina Harbor St. Marys
River Entrance Channel

Month	Total Cc	< 40 (cm)	40-50 (cm)	50-60 (cm)	60-70 (cm)	70-80 (cm)	80-90 (cm)	> 90 (cm)
Oct 91	31 ¹ (1)	0	0	15	14	2	0	0
Dec 91	45	0	1	13	19	7	5	0
Mar 92	1	0	0	1	0	0	0	0
Apr 92	*	*	*	*	*	*	*	*
May 92	3	0	0	0	2	1	0	0
Jun 92	2	0	0	0	1	0	0	1
Jul 92	4	0	1	1	2	0	0	0
Aug 92	9	0	0	3	4	2	0	0
Sep 92	7	0	0	2	3	0	1	1
Oct 92	11	0	1	3	4	2	1	0
Nov 92	8	0	0	5	3	0	0	0
Dec 92	0	0	0	0	0	0	0	0
Jan 93	0	0	0	0	0	0	0	0
Feb 93	0	0	0	0	0	0	0	0
Mar 93	2	0	0	1	0	0	1	0
Total	123 ¹ (1)	0	3	44	52	14	8	2
Total (Apr 92 - Mar 93)	46	0	2	15	19	5	3	2

¹ Number, in parentheses, of turtles captured with no SCL measurement recorded.

Note: Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 23
Size-Class Distribution by Straight Carapace Length (SCL) of Loggerheads
(Cc) Captured During Monthly Surveys From Brunswick Harbor Ocean Bar
Channel, Georgia

Month	Total Cc	<40 (cm)	40-50 (cm)	50-60 (cm)	60-70 (cm)	70-80 (cm)	80-90 (cm)	>90 (cm)
Jun 91	69	0	7	27	23	4	3	5
Sep 91	20	0	0	9	9	0	1	1
Oct 91	40 ¹ (1)	0	1	14	16	9	0	0
Nov 91	*	*	*	*	*	*	*	*
Dec 91	2	0	0	2	0	0	0	0
Jan 92	0	0	0	0	0	0	0	0
Feb 92	0	0	0	0	0	0	0	0
Mar 92	8	0	0	3	4	0	0	1
Apr 92	10	0	1	3	4	1	0	1
Dec 92	0	0	0	0	0	0	0	0
Total	149 ¹ (1)	0	9	58	56	14	4	8

* No monthly survey.

¹ Number, in parentheses, of turtles captured with no SCL measurement recorded.

Note: Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 24
Size-Class Distribution by Straight Carapace Length (SCL) of Loggerheads
(Cc) Captured During Monthly Surveys From Savannah Harbor Ocean Bar
Channel, Georgia

Month	Total (Cc)	< 40 (cm)	40-50 (cm)	50-60 (cm)	60-70 (cm)	70-80 (cm)	80-90 (cm)	> 90 (cm)
Jun 91	9	0	0	6	2	0	0	1
Aug 91	26 ¹ (1)	0	0	13	10	2	1	0
Oct 91	27 ¹ (1)	0	0	9	10	5	3	0
Nov 91	30	0	1	12	14	1	2	0
Dec 91	3	0	0	0	2	1	0	0
Jan 92	0	0	0	0	0	0	0	0
Feb 92	0	0	0	0	0	0	0	0
Mar 92	0	0	0	0	0	0	0	0
Apr 92	1	0	0	0	1	0	0	0
May 92	3	0	0	1	1	0	0	1
Jul 92	7	0	0	4	2	0	0	1
Sep 92	10 ¹ (1)	0	0	1	5	3	0	1
Oct 92	14	0	0	8	3	1	2	0
Nov 92	8 ¹ (3)	0	0	1	7	0	0	0
Dec 92	7	0	0	4	3	0	0	0
Jan 93	0	0	0	0	0	0	0	0
Mar 93	0	0	0	0	0	0	0	0
Total	145 ¹ (6)	0	1	59	60	13	8	4
Total (Apr 92 - Mar 93)	50 ¹ (4)	0	0	19	22	4	2	3

¹ Number, in parentheses, of turtles captured with no SCL measurement recorded.

Note: Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 25
Size-Class Distribution By Straight Carapace Length (SCL) of
Loggerheads (Cc) Captured During Monthly Surveys From
Charleston Harbor Entrance Channel, South Carolina

Month	Total Cc	<40 (cm)	40-50 (cm)	50-60 (cm)	60-70 (cm)	70-80 (cm)	80-90 (cm)	>90 (cm)
Aug 91	0	0	0	0	0	0	0	0
Sep 91	15	0	0	4	5	4	2	0
Mar 92	2	0	0	2	0	0	0	0
Apr 92	1	0	0	1	0	0	0	0
May 92	5	0	1	2	2	0	0	0
Jun 92	6	0	0	3	0	1	0	2
Jul 92	5	0	0	2	3	0	0	0
Aug 92	*	*	*	*	*	*	*	*
Sep 92	0	0	0	0	0	0	0	0
Oct 92	8	0	0	4	3	1	0	0
Nov 92	2	0	0	0	1	1	0	0
Dec 92	1	0	0	1	0	0	0	0
Jan 93	*	*	*	*	*	*	*	*
Feb 93	*	*	*	*	*	*	*	*
Mar 93	*	*	*	*	*	*	*	*
Total	45	0	1	19	14	7	2	2
Total (Mar 92 - Mar 93)	30	0	1	15	9	3	2	2

* No monthly surveys. Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 26
Sex Ratio of Loggerheads Captured Within Surveyed South-
eastern U.S. Hopper Dredged Channels as Determined by
External Morphological Characteristics Only

Channel	Males	Females	Undetermined	Total
Canaveral	47	36	92	175
Fernandina	3	4	126	133
Brunswick	7	5	148	160
Savannah	9	3	140	152
Charleston	0	5	42	47
Morehead	0	0	3	3
Total	66	53	551	670

Table 27

Distribution of CPUE's (turtles/hour) (All Species Combined) for Southeastern U.S. Hopper Dredged Channels Surveyed From June 1991 Through March 1993

Month	Canaveral	Fernandina	Brunswick	Savannah	Charleston	Morehead
Jun 91	*	*	0.622	0.363	*	*
Jul 91	*	*	*	*	*	*
Aug 91	*	*	*	0.397	0	*
Sep 91	*	*	0.774	*	0.121	*
Oct 91	*	3.40	1.282	1.129	*	*
Nov 91	*	*	*	1.103	*	*
Dec 91	*	0.48	0.144	0.093	*	0.037
Jan 92	*	*	0	0	*	*
Feb 92	*	*	0	0	*	*
Mar 92	0.833	0.214	0.346	0	0.263	0
Apr 92	2.985	*	0.373	0.085	0.104	0
May 92	2.263	0.266	*	0.258	0.444	0
Jun 92	3.242	0.318	*	*	0.627	0
Jul 92	1.860	0.399	*	0.705	0.490	0.131
Aug 92	0.949	0.942	*	*	*	0
Sep 92	0.295	0.845	*	0.926	0	0
Oct 92	1.159	1.100	*	1.440	1.067	0.146
Nov 92	0.826	0.923	*	1.012	0.232	0
Dec 92	0.183	0	0	0.651	0.105	0
Jan 93	1.981	0	*	0	*	0
Feb 93	0.748	0	*	*	*	0
Mar 93	*	0.197	*	0	*	*
Total	1.43	0.571	0.489	0.418	0.206	0.025

* No monthly survey. Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 28
Distribution of CPUE's (turtles/trawl) (All Species Combined) for Southeastern
U.S. Hopper Dredged Channels Surveyed From June 1991 Through March
1993

Month	Canaveral	Fernandina	Brunswick	Savannah	Charleston	Morehead
Jun 91	*	*	0.418	0.273	*	*
Jul 91	*	*	*	*	*	*
Aug 91	*	*	*	0.196	0	*
Sep 91	*	*	0.379	*	0.059	*
Oct 91	*	1.65	0.642	0.583	*	*
Nov 91	*	*	*	0.554	*	*
Dec 91	*	0.238	0.069	0.047	*	0.019
Jan 92	*	*	0	0	*	*
Feb 92	*	*	0	0	*	*
Mar 92	0.393	0.107	0.17	0	0.1	0
Apr 92	1.25	*	0.175	0.030	0.04	0
May 92	0.917	0.103	*	0.091	0.185	0
Jun 92	1.375	0.107	*	*	0.214	0
Jul 92	0.75	0.143	*	0.219	0.185	0.048
Aug 92	0.375	0.321	*	*	*	0
Sep 92	0.125	0.286	*	0.344	0	0
Oct 92	0.5	0.393	*	0.467	0.381	0.05
Nov 92	0.375	0.321	*	0.344	0.077	0
Dec 92	0.083	0	0	0.219	0.037	0
Jan 93	0.875	0	*	0	*	0
Feb 93	0.333	0	*	*	*	0
Mar 93	*	0.071	*	0	*	*
Total	0.608	0.238	0.260	0.189	0.090	0.010

* No monthly survey. Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 29

Distribution of CPUE's (turtles/nautical mile) (All Species Combined) for Southeastern U.S. Hopper Dredged Channels Surveyed From June 1991 Through March 1993

Month	Canaveral	Fernandina	Brunswick	Savannah	Charleston	Morehead
Jun 91	*	*	0.191	0.120	*	*
Jul 91	*	*	*	*	*	*
Aug 91	*	*	*	0.125	0	*
Sep 91	*	*	0.271	*	0.040	*
Oct 91	*	1.001	0.443	0.384	*	*
Nov 91	*	*	*	0.378	*	*
Dec 91	*	0.150	0.051	0.031	*	0.013
Jan 92	*	*	0	0	*	*
Feb 92	*	*	0	0	*	*
Mar 92	0.303	0.068	0.124	0	0.084	0
Apr 92	1.157	*	0.128	0.025	0.041	0
May 92	0.847	0.092	*	0.078	0.159	0
Jun 92	1.274	0.098	*	*	0.222	0
Jul 92	0.694	0.127	*	0.203	0.172	0.044
Aug 92	0.354	0.263	*	*	*	0
Sep 92	0.119	0.249	*	0.317	0	0
Oct 92	0.469	0.342	*	0.430	0.373	0.042
Nov 92	0.347	0.289	*	0.320	0.077	0
Dec 92	0.077	0	0	0.217	0.036	0
Jan 93	0.814	0	*	0	*	0
Feb 93	0.308	0	*	*	*	0
Mar 93	*	0.066	*	0	*	*
Total	0.564	0.179	0.162	0.136	0.070	0.009

* No monthly survey. Shaded area reflects standardized distance trawling protocol whereas unshaded area reflects standardized time trawling protocol.

Table 30
Distribution of Turtles Captured, Hours Trawled, and CPUE
(turtles/hour) for Surveyed Southeastern U.S. Hopper Dredged
Channels

Channel	Station #1 (Inshore)	Station #2	Station #3	Station #4 (Offshore)	Total
Number of Turtles Captured					
Canaveral	24	65	85	1	175
Fernandina	4	22	11	15	52
Savannah	13	12	7	22	54
Charleston	13	13	5	--	31
Morehead City	1	1	--	--	2
Number of Hours Trawled					
Canaveral	29.28	30.42	30.82	31.78	122.3
Fernandina	30.43	30.32	30.7	31.62	123.1
Savannah	23.8	24.4	24.8	24.42	97.4
Charleston	25.7	29.4	31.9	--	87.0
Morehead City	44.72	46.68	--	--	91.4
CPUE (Turtles/Hour)					
Canaveral	0.820	2.14	2.76	0.031	1.43
Fernandina	0.131	0.726	0.358	0.474	0.422
Savannah	0.546	0.492	0.282	0.901	0.554
Charleston	0.506	0.442	0.157	--	0.356
Morehead City	0.022	0.021	--	--	0.022
Note: Spatial distribution not analyzed for Brunswick Harbor since station sampling portocal used there during December 1992 only.					

Table 31
Seasonal Distribution of Turtles Captured and Hours Trawled Referenced to
Water Temperature for Surveyed Southeastern U.S. Hopper Dredged Channels

Channel	Seasons									
	Spring	Summer		Fall	Winter		Total			
Number of Turtles Captured and Hours Trawled										
Canaveral	60	29.4	60	20.4	24	31.4	31	32.2	175	122.3
Fernandina	8	35.4	16	29.0	61	39.0	48	129.7	133	233.1
Brunswick	20	55.5	71	114.1	65	62.0	4	95.5	160	327.1
Savannah	4	63.0	43	102.7	95	85.4	10	112.6	152	363.5
Charleston	9	32.3	11	28.2	26	157.7	1	9.5	47	227.7
Morehead	0	27.5	1	21.1	1	20.9	1	48.9	3	116.4
Total	101	243.1	202	324.4	272	396.3	95	428.3	670	1392.1
CPUE (Turtles/Hour)										
Canaveral	2.041		2.041		0.764		0.963		1.431	
Fernandina	0.226		0.552		1.564		0.370		0.571	
Brunswick	0.360		0.622		1.048		0.042		0.489	
Savannah	0.063		0.419		1.112		0.089		0.418	
Charleston	0.279		0.390		0.165		0.105		0.206	
Morehead	0		0.047		0.048		0.020		0.025	
Note: Shaded area equals number of hours trawled, whereas unshaded area equals number of turtles captured.										

Table 32
Distribution of Mean Bottom Water Temperature (°C) Measurements Taken
Within Southeastern U.S. Hopper Dredged Channels Surveyed From June
1991 Through March 1993

Month	Canaveral	Fernandina	Brunswick	Savannah	Charleston	Morehead
Jun 91	*	*	25.1	27.2	*	*
Jul 91	*	*	*	*	*	*
Aug 91	*	*	*	29.4	28.3	*
Sep 91	*	*	23.6	*	25.6	*
Oct 91	*	21.8	24.0	26.2	*	*
Nov 91	*	*	*	20.8	*	*
Dec 91	*	15.2	15.4	14.5	*	13.7
Jan 92	*	*	12.5	12.6	*	*
Feb 92	*	*	10.9	10.9	*	*
Mar 92	18.0	15.4	16.4	13.5	14.6	13.3
Apr 92	NA	*	17.1	14.9	16.4	16.4
May 92	24.0	19.6	*	18.6	17.8	20.8
Jun 92	28.7	26.8	*	*	23.0	25.6
Jul 92	28.0	NA	*	26.9	26.6	28.7
Aug 92	28.0	NA	*	*	*	27.8
Sep 92	29.0	30.4	*	27.9	27.7	23.9
Oct 92	26.0	21.0	*	21.9	21.3	21.5
Nov 92	23.7	19.0	*	21.3	20.4	19.9
Dec 92	20.0	14.7	14.1	17.6	16.8	15.9
Jan 93	19.5	15.2	*	12.4	*	12.2
Feb 93	17.0	13.5	*	*	*	6.2
Mar 93	*	17.6	*	12.3	*	*
Range	17.0-29.0	13.5-30.4	10.9-25.1	10.9-29.4	14.6-28.3	6.2-28.7

Note: * No monthly survey.

Table 33
Distribution of Mean Air Temperature (°C) Measurements Taken Within
Southeastern U.S. Hopper Dredged Channels Surveyed From June 1991
Through March 1993

Month	Canaveral	Fernandina	Brunswick	Savannah	Charleston	Morehead
Jun 91	*	*	25.0	27.2	*	*
Jul 91	*	*	*	*	*	*
Aug 91	*	*	*	20.3	29.3	*
Sep 91	*	*	23.3	*	23.8	*
Oct 91	*	22.5	21.1	22.1	*	*
Nov 91	*	*	*	15.9	*	*
Dec 91	*	13.8	14.1	16.0	*	14.6
Jan 92	*	*	13.1	11.8	*	*
Feb 92	*	*	11.9	8.5	*	*
Mar 92	18.0	14.8	17.9	20.3	16.8	13.4
Apr 92	22.0	*	17.6	16.2	21.7	18.0
May 92	23.7	18.0	*	21.9	17.5	20.3
Jun 92	28.7	27.2	*	*	21.0	27.1
Jul 92	26.7	N/A	*	32.3	24.5	33.1
Aug 92	27.5	21.8	*	*	*	32.7
Sep 92	29.0	29.4	*	26.5	27.7	18.8
Oct 92	25.7	24.0	*	22.3	23.1	20.6
Nov 92	23.5	19.6	*	18.0	22.2	22.5
Dec 92	20.0	14.7	13.7	9.7	10.6	14.3
Jan 93	19.5	15.9	*	16.8	*	7.8
Feb 93	16.5	10.0	*	*	*	11.1
Mar 93	*	18.9	*	11.4	*	*
Range	16.5-29.0	10.0-29.4	11.9-25.0	9.7-32.3	10.6-29.3	7.8-33.1

Note: * No monthly survey.

Table 34
Distribution of Turtles Captured Referenced to Water Temperature for
Surveyed Southeastern U.S. Hopper Dredged Channels

Channel	Water Temperature (°C)									
	≤ 16		17-20		21-24		≥ 25		Total	
Number of Turtles Captured and Hours Trawled										
Canaveral	0	0	39	41.8	61	36.6	75	48.9	175	122.3
Fernandina	13	116.6	58	61.6	36	16.4	26	38.5	133	233.1
Brunswick	3	108.6	29	42.5	48	58.3	80	117.8	160	327.1
Savannah	2	153.2	15	22.4	55	46.7	80	139.3	152	363.6
Charleston	3	15.1	7	33.1	16	19.2	21	160.2	47	227.7
Morehead	1	66.6	0	12.1	1	18.6	1	21.1	3	118.4
Total	22	480.1	148	213.5	217	191.8	283	526.8	670	1,392.2
CPUE (Turtles/Hour)										
Canaveral	0		0.933		1.99		1.50		1.43	
Fernandina	0.111		0.942		2.20		0.675		0.571	
Brunswick	0.028		0.682		0.823		0.679		0.489	
Savannah	0.013		0.670		1.13		0.574		0.418	
Charleston	0.199		0.211		0.833		0.131		0.206	
Morehead	0.015		0		0.054		0.047		0.025	
Total	0.048		0.693		1.131		0.537		0.481	

Note: Shaded area equals number of hours trawled, while unshaded area equals number of turtles captured.

Appendix A

Turtle Trawl Net Specifications and Data Sheets

Sea Turtle Trawl Net Specifications

Design:	4 seam, 4 legged, 2 bridal trawl net
Webbing:	4 in. bar, 8 in. stretch top - 36 gauge twisted nylon dipped side - 36 gauge twisted nylon dipped bottom - 84 gauge braided nylon dipped
Net Length:	60 ft from cork line to cod end
Body Taper:	2 to 1
Wing End Height:	6 ft
Center Height:	Dependent on depth of trawl, 14 to 18 ft
Cod End:	Length 50 meshes x 4 in. = 16.7 ft Webbing 2-in. bar, 4-in. stretch, 84 gauge braid nylon dipped, 80 meshes around, 40 rigged meshes with 1/4 x 2 in. choker rings, 1 each 1/2 x 4 in. at end
Cod End Cover:	none
Chaffing Gear:	none
Head Rope:	60 ft 1/2 in. combination rope (braid nylon with stainless cable center)
Foot Rope:	65 ft 1/2 in. combination rope
Leg Line:	top - 6 ft, bottom - 6 ft

Floats:	size - tuna floats (football style), diameter - 7-in. length - 9 in., number - 12 each, spacing - center on top net 2 in. apart
Mud Rollers:	size 5-in. diameter, 5.5-in. length, number - 22 each, spacing - 3 ft attached with 3/8-in. polypropelene rope (replaced with snap-on rollers when broken)
Tickler Chains:	None (discontinued- but previously used 1/4-in. x 74-ft galvanized chain)
Weight:	20 ft of 1/4-in. galvanized chain on each wing, 40 ft per net looped and tied
Door Size:	8 ft x 40 in. (or 9 ft x 40 in.), Shoe - 1 in. x 6 in., bridles - 3/8-in.-high test chain
Cable Length:	(bridle length, total): 7/16 in. x 240-300 ft, varies with bottom conditions
Float Ball:	none
Lazy Lines:	1-in. nylon
Pickup Lines:	3/8-in. polypropelene
Whip Lines:	1-in. nylon

Canaveral Harbor, Florida

Manufacturer:	Billy Burbank, Jr., Fernandina, FL
Design:	2 seam, 3 bridal, mongoose style trawl net
Webbing:	4-in. bar, 8-in. stretch, 48 denier (gauge) twisted nylon and dipped; net length from wing tip to cod end is 66 ft; body designed with a 4 and 1 taper; wing depending upon depth of trawl
Cod End:	13-ft long made of 4-in. stretch, 60 denier twisted nylon designed as 70 meshes around x 40 meshes rigged with standard choker rings 5/16 x 2.5 in. with a 7-in. stretch # 260 polyethylene cod end cover or chaffing gear
Head Rope:	60 ft, 7/16 poly-combination cable

Foot Rope: 61 ft, 7/16 poly-combination cable

Floats: long-line float attached to center cable (at tongue); two 8-in. deep water floats attached at each wing

Mud Rollers: white, clip-on 7 ft x 5 in. mud rollers were attached to foot rope and spaced 5 ft apart

Door Size: 11 ft x 40; 9 ft x 40

Cable Length: (= bridal length) depended on channel bottom conditions

Tickler Chain: no tickler chains were used

TRAWLING INFORMATION:

Channel:	Vessel:	Captain:
Crew:		

Date:
Tow #:
Shift #:
Dredge Location:
Total Tow Time: _____ Min.

Survey:	<input type="checkbox"/>
Relocation:	<input type="checkbox"/>
PreDredge:	<input type="checkbox"/>

Substrate:	Mud:	<input type="checkbox"/>
	Sand:	<input type="checkbox"/>
	Rocks:	<input type="checkbox"/>
	Snag:	<input type="checkbox"/>

Low Tide Time:
High Tide Time:
Ebb: <input type="checkbox"/>
Flood: <input type="checkbox"/>
Slack Ebb: <input type="checkbox"/> Slack Flood: <input type="checkbox"/>

Water Temp. (B: °C) (M: °C) (S: °C)
Wave Height: _____ ft.
Air Temperature: _____ °C
Wind Speed/Direction:
Barometric Pressure:

Dir: In <input type="checkbox"/> Out <input type="checkbox"/>	Loc: Green <input type="checkbox"/> Center <input type="checkbox"/> Red <input type="checkbox"/>
---	--

Begin Tow:	
Time:	
Depth:	ft.
Speed Mid-Tow:	knots
Latitude:	
Longitude:	
Loran:	
Station/Buoys:	

End Tow:	
Time:	
Depth:	ft.
Total Tow Distance:	ft.
Latitude:	
Longitude:	
Loran:	
Station/Buoys:	

Number of Turtles	
Port Net:	Starboard Net:
Logger:	Logger:
Kemp:	Kemp:
Green:	Green:

Bycatch/Comments:

Page #:

SEA TURTLE INFORMATION:

Channel:
Date:
Tow #:

_____ of _____

Turtle Species:	Net: Port <input type="checkbox"/> Starboard <input type="checkbox"/>
-----------------	---

Flipper Tag #	
Left:	
Right:	
Recapture:	This effort: <input type="checkbox"/>
	Previous effort: <input type="checkbox"/>

Sex:
Male: <input type="checkbox"/>
Female: <input type="checkbox"/>
Unk: <input type="checkbox"/>

Weight:
kg
lbs

Head Width:
cm
in

Carapace S.L. Length:
cm
in

CCL: _____ cm.

S.L. Width:
cm
in

CCW: _____ cm.

Tail Length
(from plastron to tip:)
cm

Photos Taken:
Yes <input type="checkbox"/>
No <input type="checkbox"/>

Blood Taken:
Yes <input type="checkbox"/>
No <input type="checkbox"/>
Time:

of vials: _____

_____ Mhz
_____ Khz

Telemetry Tag:
Radio <input type="checkbox"/>
Sonic <input type="checkbox"/>
Satellite <input type="checkbox"/>

General condition of Turtle:
CPL: _____ cm.
CPW: _____ cm.
PIT TAG#

Turtle Released
Date:
Time:

Release Location
Lat:
Long:

Location:

Appendix B

Trawling Protocol Meeting

Participants

**U.S. Army Corps of Engineers Sea Turtle Trawling Survey
Protocol Technical Committee Participants, 14 January 1992,
Atlanta, GA**

Name	Affiliation	Location
William Adams	USAE District, Wilmington	Wilmington, NC
Robert Ballard	USAE Waterways Experiment Station	Vicksburg, MS
Alan Bolten	Center for Sea Turtle Research, University of Florida	Gainesville, FL
David Crosby	USAE District, Savannah	Savannah, GA
Dena Dickerson	USAE Waterways Experiment Station	Vicksburg, MS
Mike Harris	Georgia Department of Natural Resources	Brunswick, GA
Eric Hawk	NMFS, Southeast Region	St. Petersburg, FL
Terry Henwood	NMFS, Southeast Region	St. Petersburg, FL
Jan Hoover	USAE Waterways Experiment Station	Vicksburg, MS
Richard Kasul	USAE Waterways Experiment Station	Vicksburg, MS
John Keinath	Virginia Institute of Marine Science	Gloucester Point, VA
John Musick	Virginia Institute of Marine Science	Gloucester Point, VA
David Nelson	USAE Waterways Experiment Station	Vicksburg, MS
Douglas Nester	USAE District, Mobile	Mobile, AL
Rudy Nyc	USAE South Atlantic Division	Atlanta, GA
Larry Ogren	NMFS (Retired)	Panama City, FL
Jim O'Hara	University of South Carolina	Aiken, SC
Lindsey Parker	University of Georgia, Marine Extension Service	Brunswick, GA
James Richardson	Institute of Ecology, University of Georgia	Athens, GA
Keith Sjostrom	USAE Waterways Experiment Station	Vicksburg, MS
Robert Van Dolah	South Carolina Wildlife and Marine Resources Division	Charleston, SC
Trudy Wilder	USAE District, Wilmington	Wilmington, NC
Mark Wolff	USAE District, Jacksonville	Jacksonville, FL
Jim Woody	USAE District, Charleston	Charleston, SC

Appendix C

Summary of Sea Turtle Captures

Legend

SP. = species

WGT = weight, kg

SCL = straight line carapace length, cm

HW = head width, cm

SCW = straight line carapace width, cm

* = Information not available

Table C1
Summary of Turtles Captured During Monthly Surveys From
Canaveral Harbor Entrance Channel Florida

Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release Loran
X 2524/2525	3/6/92	Cc	87.0	70.2	*	17.8	F	43921.0/62015.0
X 2526/2527	3/7/92	Cc	65.3	54.4	*	13.7	U	43921.0/62015.0
X 2528/2529	3/7/92	Cc	93.9	72.3	*	18.4	M	43921.0/62015.0
X 2530/2531	3/7/92	Cc	80.7	63.9	*	17.7	U	43939.5/62022.1
X 2532/2533	3/8/92	Cc	61.6	48.1	*	12.5	U	43939.5/62022.1
X 2534/2535	3/8/92	Cc	51.7	45.1	*	11.0	U	43921.0/62015.0
X 2536/2537	3/8/92	Cc	50.5	42.3	*	10.6	U	43921.0/62015.0
X 2538/2539	3/8/92	Cc	48.2	41.0	*	10.2	U	43939.5/62022.1
X 2540/2541	4/13/92	Cc	102.5	75.7	*	23.8	M	43957.2/62028.5
X 2542/2543	4/13/92	Cc	108.7	79.9	*	25.5	M	43957.2/62028.5
X 2544/2545	4/13/92	Cc	88.6	67.5	*	19.1	M	43939.5/62022.1
X 2546/2547	4/13/92	Cc	96.6	69.7	*	19.1	M	43921.0/62015.0
X 2548/2549	4/13/92	Cc	109.8	80.5	*	22.7	M	43939.5/62022.1
X 2550/2551	4/13/92	Cc	98.6	74.7	*	19.4	M	43939.5/62022.1
X 2552/2553	4/13/92	Cc	102.6	78.0	*	22.5	M	43957.2/62028.5
X 2554/2555	4/15/92	Cc	91.6	68.8	*	21.5	M	43957.2/62028.5
X 2556/2557	4/15/92	Cc	69.0	55.7	*	14.1	U	43957.2/62028.5
X 2558/2559	4/15/92	Cc	86.6	67.9	*	17.7	M	43939.5/62022.1
X 2560/2561	4/15/92	Cc	80.1	63.2	*	17.0	U	43921.0/62015.0
X 2562/2563	4/15/92	Cc	NA	68.0	*	16.6	M	43921.0/62015.0
X 2564/2565	4/15/92	Cc	90.3	66.0	*	21.2	F	43921.0/62015.0
X 2566/2567	4/15/92	Cc	85.2	69.6	*	18.3	M	43921.0/62015.0
X 2568/2569	4/15/92	Cc	67.9	55.9	*	14.2	U	43921.0/62015.0
X 2570/2571	4/15/92	Cc	93.6	71.1	*	20.3	M	43921.0/62015.0
X 2572/2573	4/15/92	Cc	80.8	60.8	*	16.6	M	43921.0/62015.0
X 2574/2575	4/15/92	Cc	93.7	72.1	*	22.2	M	43957.2/62028.5
X 2576/2577	4/15/92	Cc	62.5	53.6	*	13.1	U	43939.5/62022.1
X 2578/2579	4/15/92	Cc	87.7	69.4	*	19.6	M	43939.5/43921.0
X 2580/2581	4/15/92	Cc	66.2	52.0	*	13.5	U	43957.2/62028.5
(Sheet 1 of 6)								

Table C1 (Continued)								
Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release Loran
X 2582/2583	4/16/92	Cc	104.2	77.9	*	21.6	M	43957.2/62028.5
X 2584/2585	4/16/92	Cc	63.5	55.0	*	13.0	U	43939.5/62022.1
PPY 542/543 BBC 618	4/16/92	Cc	61.4	50.4	*	12.7	U	43921.0/62015.0
X 2586/2587	4/16/92	Cc	81.0	63.3	*	16.1	U	43921.0/62015.0
X 2588/2589	4/16/92	Cc	61.7	50.7	*	12.7	U	43939.5/62022.1
X 2590/2591	4/16/92	Cc	62.3	50.8	*	12.7	U	43939.5/62022.1
X 2592/2593	4/16/92	Cc	96.2	70.3	*	20.2	M	43939.5/62022.1
X 2594/2595	4/16/92	Cc	105.1	81.7	*	23.0	M	43939.5/62022.1
X 2596/2597	4/16/92	Cm	52.0	41.7	*	7.9	U	43957.2/62028.5
X 2598/2599	5/12/92	Cc	93.3	66.9	*	21.9	M	43920.2/62015.2
X 2600/2601	5/12/92	Cc	84.3	61.9	*	17.1	F	43906.3/62009.9
X 2602/2603	5/12/92	Cc	40.2	34.4	*	8.1	U	43968.4/62034.8
X 2604/2605	5/12/92	Cc	90.5	69.2	*	20.2	M	43965.3/62037.5
X 2542/2543	5/12/92	Cc	108.8	74.4	*	25.3	M	43965.3/62037.5
X 2608/2609	5/13/92	Cc	105.6	80.0	*	26.6	M	43939.3/62022.1
X 2610/2611	5/13/92	Cc	48.8	43.0	*	10.3	U	43924.5/62016.3
X 2612/2613	5/13/92	Cc	98.3	74.6	*	22.5	F	43905.4/62010.3
X 2614/2615	5/13/92	Cc	52.4	42.6	*	10.9	U	43967.0/62036.8
X 2616/2617	5/13/92	Cc	60.9	49.0	*	12.4	U	43948.5/62047.5
X 2582/2583	5/14/92	Cc	104.3	78.8	*	21.7	M	43906.8/62009.9
X 2618/2619	5/14/92	Cc	50.3	41.9	*	10.1	U	43906.8/62009.9
X 2620/2621	5/14/92	Cc	99.5	76.3	*	20.2	M	43923.4/62015.9
X 2622/2623	5/14/92	Cc	99.1	73.7	*	18.4	M	43923.4/62015.9
X 2624/2625	5/14/92	Cc	101.7	73.4	*	23.0	M	43923.4/62015.9
X 2626/2626	5/14/92	Cc	99.0	74.5	*	18.7	M	43956.2/62028.0
X 2628/2629	5/14/92	Cc	88.9	67.0	*	21.1	F	43956.2/62028.0
X 2630/2631	5/14/92	Cc	81.1	60.8	*	17.0	M	43968.9/62033.5
X 2632/2633	5/14/92	Cc	56.8	48.4	*	11.4	U	43968.9/62033.5
X 2634/2635	5/14/92	Cc	97.4	74.0	*	18.7	M	43970.6/62020.3
X 2636/2637	5/14/92	Cc	83.6	66.6	*	17.4	M	43970.6/62020.3
X 2550/2551	5/14/92	Cc	99.1	74.0	*	19.8	M	43970.6/62020.3
(Sheet 2 of 6)								

Table C1 (Continued)

Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release Loran
X 2638/2639	6/17/92	Cc	81.5	65.5	*	17.1	U	43904.2/62009.0
X 2640/2641	6/17/92	Cc	104.0	81.9	*	21.0	F	43968.4/62030.5
QQH 866/867	6/17/92	Cc	75.6	58.5	*	18.3	U	43923.2/62016.0
QQM 495/496	6/17/92	Cc	81.6	64.6	*	18.4	U	43968.4/62030.5
X 2646/2647	6/17/92	Cc	93.9	74.7	*	19.3	F	43968.4/62030.5
X 2642/2643	6/17/92	Cc	88.8	71.5	*	19.6	F	43968.4/62030.5
X 2644/2645	6/17/92	Cc	93.0	68.7	*	21.1	F	43968.4/62030.5
X 2648/2649	6/17/92	Cc	90.5	71.7	*	20.3	F	43968.4/62030.5
X 2650/2651	6/17/92	Cc	90.1	67.1	*	20.3	F	43968.4/62030.5
X 2652/2653	6/17/92	Cc	82.1	63.5	*	17.5	U	43968.4/62030.5
X 2654/2655	6/17/92	Cc	84.7	66.5	*	18.6	M	43968.4/62030.5
X 2656/2657	6/17/92	Cc	91.1	65.3	*	19.2	F	43968.4/62030.5
X 2658/2659	6/18/92	Cc	97.8	76.8	*	19.8	F	43920.1/62015.1
X 2660/2661	6/18/92	Cc	89.0	67.7	*	20.7	F	43967.3/62022.9
X 2662/2663	6/18/92	Cc	92.9	72.5	*	18.2	F	43940.2/62022.9
X 2664/2665	6/18/92	Cc	*	*	*	*	U	43907.3/62009.4
X 2666/2667	6/18/92	Cc	101.4	80.3	*	23.9	F	43940.2/62022.9
X 2668/2669	6/18/92	Cc	91.5	76.5	*	19.2	F	43967.3/62030.7
X 2670/2671	6/18/92	Cc	93.7	74.5	*	19.8	F	43967.3/62030.7
X 2672/2673	6/18/92	Cc	95.1	74.0	*	19.4	F	43967.3/62030.7
X 2674/2675	6/19/92	Cc	67.0	53.1	*	14.3	U	43968.7/62026.7
X 2676/2677	6/19/92	Cc	91.0	73.9	*	18.7	F	43962.9/62027.7
X 2678/2679	6/19/92	Cc	93.3	68.5	*	19.2	F	43958.6/62028.1
X 2680/2681	6/19/92	Cc	90.4	69.8	*	18.7	F	43964.4/62027.2
X 2682/2683	6/19/92	Cc	82.4	61.1	*	15.3	U	43966.9/62027.1
X 2684/2685	6/19/92	Cc	93.7	69.1	*	18.5	F	43960.8/62028.8
X 2686/2687	6/19/92	Cc	87.6	73.5	*	19.3	F	43958.0/62028.7
X 2688/2689	6/19/92	Cc	96.3	69.8	*	22.4	F	43959.6/62027.4
X 2690/2691	6/19/92	Cc	95.1	74.7	*	19.6	F	43960.8/62028.8
X 2692/2693	6/19/92	Cm	98.5	77.7	*	13.8	U	43962.1/62028.2
QQH 949/948 X 2694	6/19/94	Cc	71.1	58.1	*	13.9	U	43970.4/62037.3
(Sheet 3 of 6)								

Table C1 (Continued)								
Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release Loran
X 2695/2696	7/08/92	Cc	91.2	70.6	104.5	18.9	M	43926.7/62019.1
X 2697/2698	7/08/92	Cc	84.2	63.7	79.5	16.9	F	43926.7/62017.0
X 2699/2700	7/08/92	Cc	94.7	73.9	111.4	19.9	F	43926.7/62017.0
X 2701/2702 PPS 834/835	7/08/92	Cc	72.1	58.2	61.4	15.8	U	43931.7/62019.1
X 2703/2704	7/08/92	Cc	96.1	72.8	129.5	19.7	F	43969.8/62032.7
X 2705/2706	7/09/92	Cc	91.2	66.6	104.5	17.7	F	43944.3/62023.6
X 2707/2708	7/09/92	Cc	91.2	69.7	102.3	19.2	F	43963.7/62028.1
X 2612/2613	7/09/92	Cc	98.1	74.6	129.5	22.4	F	43956.6/62027.2
X 2709/2710 X 3087/3088	7/09/92	Cc	91.8	69.0	104.5	19.9	F	43966.1/62037.7
X 2711/2712 X 4050	7/09/92	Cc	91.1	78.5	118.2	19.6	F	43963.9/62037.4
X 2713/2714	7/09/92	Cc	90.6	70.1	100.0	19.0	F	43963.9/62037.4
X 2715/2716	7/9/92	Cc	85.7	62.9	84.1	18.9	F	43966.1/62037.7
X 2717/2718	7/10/92	Cc	63.4	54.1	34.1	12.5	U	43930.5/62019.1
X 2719/2720	7/10/92	Cc	96.0	73.9	127.3	21.0	F	43955.2/62029.1
X 2721/2722	7/10/92	Cc	97.7	75.9	129.5	19.3	F	43948.3/62024.9
X 2723/2724	7/10/92	Cc	84.7	62.4	75.0	17.2	F	43944.5/62023.4
X 2727/2728	7/10/92	Cc	97.1	73.0	131.8	22.0	F	43958.0/62029.8
X 2725/2726	7/10/92	Cc	86.6	65.0	86.4	16.5	F	43944.5/62023.4
X 1048/1049	8/11/92	Cc	96.4	74.5	131.8	25.1	F	43956.6/62029.4
X 1050/1051	8/11/92	Cc	90.5	68.0	93.2	17.5	F	43966.1/62036.4
X 1052/1053	8/11/92	Cc	67.8	52.9	40.9	12.6	U	43962.2/62036.6
X 1054/1055	8/12/92	Cc	82.1	65.7	88.6	16.6	U	43967.2/62030.8
X 1056/1057	8/12/92	Cc	54.6	43.8	22.7	10.7	U	43965.5/62039.3
X 1058/1059	8/13/92	Cc	89.0	70.4	102.3	19.8	F	43947.7/62021.9
X 1060/1061	8/13/92	Cc	54.1	47.0	22.7	11.1	U	43959.9/62030.6
X 1062/1063	8/13/92	Cc	59.0	49.9	34.1	12.2	U	43959.9/62030.6
X 1064/1065	8/13/92	Cc	67.7	55.1	38.6	13.7	U	43959.9/62030.6
X 1070/1071	9/02/92	Cc	82.3	68.7	68.2	16.2	U	43970.4/62036.8
X 1072/1073	9/04/92	Cc	98.7	70.9	127.3	21.4	M	43960.6/62029.8
X 1074/1075	9/04/92	Cc	60.9	49.1	31.8	12.6	U	43949.9/62025.8
(Sheet 4 of 6)								

Table C1 (Continued)

Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release Loran
X 1078/1079	10/13/92	Cc	87.2	70.7	94.5	19.6	F	43922.5/62015.6
X 1080/1081	10/13/92	Cc	53.5	43.4	22.5	11.1	U	43954.7/62027.7
QQC 369/370 X 1082	10/13/92	Cc	74.1	59.5	52.3	14.6	U	43956.3/62029.3
X 1083/1084	10/13/92	Cc	53.3	47.1	20.5	11.2	U	43966.2/62032.1
X 1085/1086	10/13/92	Cc	65.2	55.4	36.4	13.2	U	43966.2/62032.1
X 1087/1088	10/14/92	Cc	76.3	60.3	58.5	15.6	U	43965.3/62033.4
X 1089 PPW 304	10/14/92	Cc	61.3	49.7	29.5	12.9	U	43966.6/62033.9
X 1090/1091	10/15/92	Cc	83.3	64.8	81.0	18.0	F	43922.0/62015.8
X 1092/1093	10/15/92	Cc	62.1	50.4	31.5	12.1	U	43918.9/62014.7
X 1094/1095	10/15/92	Cc	62.5	51.9	34.0	12.7	U	43918.9/62014.7
X 1096/1097	10/15/92	Cc	92.7	67.0	100.0	18.9	M	43970.3/62029.0
X 1099/1100	10/15/92	Cc	61.5	53.0	34.0	12.2	U	43970.3/62029.0
X 1701/1702	11/13/92	Cc	89.5	67.3	95.5	17.9	F	43920.5/62014.7
X 1703 PPS 979	11/13/92	Cc	60.0	48.5	31.8	12.5	U	43918.5/62013.9
X 1704/1705	11/13/92	Cc	68.0	68.0	53.9	14.3	U	43918.5/62013.9
X 1706/1707	11/13/92	Cc	57.2	47.3	29.5	12.0	U	43953.5/62026.7
X 1708/1709	11/14/92	Cc	87.7	64.8	79.5	18.3	M	43961.3/62026.9
X 1710/1711	11/14/92	Cc	57.6	47.4	25.0	12.1	U	43960.4/62026.3
X 1712/1713	11/15/92	Cc	66.3	52.7	38.6	14.0	U	43923.4/62016.0
X 1714/1715 X 940	11/15/92	Cc	67.9	54.8	47.7	14.7	U	43952.6/62027.5
X 1716 QQE 877	11/15/92	Cc	57.5	44.8	25.0	12.2	U	43967.4/62034.1
X 1717/1718	12/09/92	Cc	53.0	44.8	25.9	11.1	U	43968.3/62034.7
X 1719/1720	12/10/92	Cc	50.8	44.2	21.4	9.6	U	43970.7/62037.1
X 1721/1722	1/22/93	Cc	54.1	45.9	29.5	12.0	U	43904.0/62009.3
X 1723/1724	1/22/93	Cc	57.0	48.8	27.3	11.6	U	43904.0/62009.3
X 1725/1726	1/22/93	Cc	53.0	45.7	25.0	25.0	U	43969.9/62036.8
X 1727/1728	1/22/93	Cc	57.0	46.8	27.3	11.4	U	43964.6/62035.9
X 1729/1730	1/22/93	Cc	64.5	50.2	40.9	13.2	U	43969.9/62036.8

(Sheet 5 of 6)

Table C1 (Concluded)

Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release Loran
X 1731/1732	1/22/93	Cc	64.1	50.7	36.4	12.6	U	43969.9/62036.4
QQT 066/067	1/22/93	Cc	57.9	48.8	29.5	11.4	U	43964.6/62035.9
X 2576/2577	1/23/93	Cc	63.0	53.2	38.6	13.6	U	43968.1/62036.2
X 1733/1734	1/23/93	Cc	71.3	54.9	43.2	12.4	U	43968.1/62036.2
X 1735/1736	1/23/93	Cc	56.5	48.8	27.3	11.3	U	43968.1/62036.2
X 1737/1738	1/23/93	Cc	47.0	40.5	15.9	10.0	U	43968.1/62036.2
X 1739/1740	1/23/93	Lk	30.8	28.4	9.1	6.7	U	43968.1/62036.2
X 1741/1742	1/23/93	Cc	60.7	51.9	31.8	11.5	U	43968.1/62036.2
X 1743/1744	1/23/93	Cc	53.7	47.4	25.0	10.5	U	43968.1/62036.2
X 1745/1746	1/24/93	Cc	54.7	46.8	25.0	10.9	U	43953.6/62027.5
X 1747/1748	1/24/93	Cc	60.3	50.6	36.4	12.4	U	43929.3/62018.1
X 1749/1750	1/24/93	Cc	63.6	53.3	38.6	12.8	U	43929.3/62018.1
X 2584/2585	1/24/93	Cc	63.4	54.8	40.9	13.4	U	43968.3/62034.7
X 1751/1753	1/24/93	Cc	62.4	49.4	36.4	14.7	U	43968.3/62034.7
BBA 829 QQC 641	1/24/93	Cc	62.2	51.7	31.8	12.9	U	43968.3/62034.7
QQM 499/500 X 1754	1/24/93	Cc	57.2	47.4	25.0	12.1	U	43968.3/62034.7
X 1757/1758	2/19/93	Cc	58.4	50.4	34.1	11.6	U	43967.6/62035.9
X 1759/1760	2/20/93	Cc	89.0	70.3	104.5	17.4	M	43969.2/62036.3
X 1761/1762	2/20/93	Cc	56.4	44.8	22.7	11.2	U	43969.2/62036.3
X 1763/1764	2/20/93	Cc	74.8	60.6	56.8	17.0	U	43969.2/62036.3
X 1765/1766	2/21/93	Cc	57.6	49.5	22.7	11.7	U	43950.8/62026.0
X 1767/1768	2/21/93	Cc	56.2	47.4	34.1	11.9	U	43968.3/62034.6
X 1769/1770	2/21/93	Cc	50.4	42.5	22.7	9.7	U	43968.3/62034.6

(Sheet 6 of 6)

Table C2
Summary of Turtles Captured During Monthly Surveys From
Fernandina Harbor St. Marys River Entrance Channel

Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release LAT/LON
QQR 317/318	10/08/91	Cc	66.7	53.4	43.0	12.7	U	304279/811984
QQR 321/322	10/08/91	Cc	54.8	44.4	25.0	11.2	U	304278/811814
QQR 319/320	10/08/91	Cc	60.5	50.8	31.0	11.9	U	304278/811814
QQR 323/324	10/08/91	Cc	71.4	57.3	48.0	14.8	U	304278/811814
QQR 325/326	10/08/91	Cc	59.0	49.0	26.0	4.5	U	NMFS
QQR 327/328	10/08/91	Lk	60.7	60.6	33.6	12.3	U	304292/811938
QQR 329/330	10/08/91	Cc	62.5	52.0	34.0	14.0	U	304272/812137
*QQR 331/332	10/09/91	Cc	60.5	52.0	31.0	11.4	U	304269/812155
QQR 333/334	10/09/91	Cc	63.6	52.4	37.0	12.9	U	304289/811775
QQR 335/336	10/09/91	Cc	56.0	48.5	28.5	12.5	U	304289/811775
QQR 317/318	10/09/91	Cc	66.7	53.4	46.0	12.7	U	304281/812016
QQR 337/338	10/09/91	Cc	*	52.6	38.0	12.8	U	304281/812016
QQR 339/340	10/09/91	Cc	53.0	45.0	28.2	11.5	U	304278/812160
QQR 341/342	10/09/91	Cc	58.0	47.0	29.5	12.5	U	304282/812132
QQR 344/345	10/09/91	Cc	59.0	49.0	29.0	12.5	U	304279/812105
QQR 346/348	10/09/91	Cc	66.6	51.4	43.0	12.7	U	304282/812078
QQR 349/350	10/09/91	Cc	68.7	57.3	46.4	13.2	U	304304/812058
QQR 202/203	10/09/91	Cc	65.0	54.0	38.0	14.5	U	304286/812105
QQR 204/205	10/09/91	Cc	63.0	50.5	36.0	12.5	U	304282/812310
QQR 206/207	10/10/91	Cc	61.0	51.0	32.0	12.6	U	304297/811933
QQR 331/332	10/10/91	Cc	60.5	52.0	31.0	11.4	U	304288/811965
QQR 208/209	10/10/91	Cc	58.5	45.8	27.0	12.0	U	304306/811767
QQR 210/211	10/10/91	Cc	53.4	44.3	22.8	11.0	U	304294/812000
QQR 212/213	10/10/91	Cc	58.5	46.5	26.0	12.7	U	304271/812317
QQR 214/215	10/10/91	Cc	57.7	47.2	27.0	12.7	U	304263/812401
QQR 216/217	10/10/91	Cc	66.5	55.4	41.0	13.0	U	304277/812185
QQR 218/219	10/10/91	Cc	70.7	59.5	42.0	14.4	U	304270/811793
QQR 220/221	10/10/91	Cc	56.5	47.0	27.0	11.0	U	304270/811793
QQR 222/223	10/10/91	Cc	58.0	47.0	*	12.5	U	304270/811793

(Sheet 1 of 5)

Table C2 (Continued)								
Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release LAT/LON
QQR 224/225	10/10/91	Cc	56.7	44.5	25.0	11.5	U	304256/811775
QQR 225/227	10/10/91	Cc	56.0	48.0	25.0	11.1	U	304281/811819
QQR 228/229	10/10/91	Cc	61.5	50.0	31.0	12.2	U	304278/812172
QQR 230/231	10/10/91	Cc	63.3	52.4	34.5	12.5	U	304264/812391
QQR 232/233	10/10/91	Cc	54.1	44.8	23.5	11.2	U	304264/812391
QQS 051/052	12/10/91	Cc	76.1	59.4	57.0	15.5	U	304055/812104
QQS 053/054	12/10/91	Cc	66.4	54.2	42.0	14.0	U	304055/812109
QQS 055/056	12/10/91	Cc	82.3	65.1	77.0	17.3	U	304055/812109
QQS 059/060	12/10/91	Cc	69.8	57.0	55.0	15.7	U	304055/812109
QQS 057/058	12/10/91	Cc	59.2	49.8	32.0	12.8	U	304055/812109
QQS 061/062	12/10/91	Cc	71.9	57.7	52.0	15.3	U	304055/812109
QQS 063/064	12/11/91	Cc	83.0	66.6	69.0	18.3	F	304034/811928
QQS 065/066	12/11/91	Cc	64.9	51.7	40.0	13.6	U	304034/811928
QQS 073/074	12/12/91	Lk	37.4	34.8	7.0	9.2	U	304033/812184
QQS 069/070	12/12/91	Cc	72.3	55.8	47.0	14.0	U	304033/812184
QQS 067/068	12/12/91	Cc	57.0	48.2	27.0	12.4	U	304033/812184
QQS 071/072	12/12/91	Cc	62.6	55.1	34.0	12.2	U	304033/812184
QQR 333/334	12/12/91	Cc	63.9	52.8	36.0	13.4	U	304033/812184
QQS 075/076	12/12/91	Cc	68.7	56.7	46.0	15.0	U	304033/812050
QQS 077/078	12/12/91	Cc	57.3	46.4	25.0	13.1	U	304033/812050
QQS 079/080	12/13/91	Cc	74.9	58.7	54.0	16.3	U	304033/812050
QQS 081/082	12/13/91	Cc	68.7	55.7	45.0	13.5	U	304033/812050
QQS 083/084	12/13/91	Cc	62.1	51.3	35.0	13.6	U	304033/812050
QQS 085/086	12/13/91	Cc	65.5	50.8	36.0	13.2	U	304033/812050
QQS 087/089	12/14/91	Lk	40.0	37.2	8.0	9.1	U	303999/812164
QQS 090/092	12/14/91	Cc	69.4	52.6	41.0	14.0	U	303999/812164
QQS 093/094	12/14/91	Cc	65.6	53.3	41.0	14.2	U	303999/812164
QQS 095/096	12/14/91	Cc	70.4	57.8	55.0	16.6	U	304025/812091
QQS 097/098	12/14/91	Cc	47.6	49.4	32.0	13.4	U	304025/812091
QQS 099/100	12/14/91	Cc	64.7	49.7	39.0	14.0	U	304025/812091
QQS 101/102	12/14/91	Cc	63.4	51.9	33.0	12.9	U	304025/812091
QQS 103/104	12/15/91	Cc	59.5	52.0	30.0	12.9	U	304025/812091
(Sheet 2 of 5)								

Table C2 (Continued)

Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release LAT/LON
QQS 105/106	12/15/91	Cc	61.9	50.9	31.0	12.4	U	304025/812091
QQS 107/108	12/15/91	Cc	58.0	47.8	26.0	11.8	U	304025/812097
QQS 109/110	12/15/91	Cc	53.4	45.7	22.0	11.9	U	304025/812091
QQS 113/114	12/15/91	Cc	52.8	46.0	24.0	11.3	U	303974/812173
QQS 111/112	12/15/91	Cc	60.1	51.3	35.0	12.4	U	303974/812173
QQS 115/116	12/15/91	Cc	68.2	55.7	46.0	14.7	U	303974/812173
QQS 119/120	12/15/91	Cc	51.3	44.1	23.0	11.5	U	303974/812173
QQS 121/122	12/15/91	Cc	86.2	69.3	94.0	18.8	M	303974/812173
N/A	12/16/91	Cm	30.4	24.9	4.0	5.1	U	304070/812081
QQS 123/124	12/16/91	Cc	57.9	47.4	27.0	13.0	U	304070/812081
QQS 125/126	12/16/91	Cc	65.2	49.9	39.0	13.8	U	304070/812081
QQS 127/128	12/16/91	Cc	53.3	45.2	23.0	11.7	U	304070/812081
QQS 129/130	12/17/91	Cc	59.1	*	31.0	*	U	304109/811915
QQS 131/132	12/17/91	Cc	66.1	*	45.0	*	U	304109/811915
QQS 133/134	12/18/91	Cc	68.7	*	46.0	*	U	303984/812007
QQS 135 PPT 150	12/18/91	Cc	75.2	*	51.0	*	U	303984/812007
QQM 331/332	12/18/91	Cc	88.4	70.6	136.0	*	F	303984/812007
QQS 136/137	12/18/91	Cc	56.8	*	29.0	*	U	303984/812007
QQS 138/140	12/19/91	Cc	85.5	*	80.8	*	M	302850/811765
QQS 141/142	12/22/91	Cc	70.7	*	47.0	*	U	303937/812211
QQN 168/169	12/31/91	Cc	59.9	50.0	*	13.1	U	304122/811970
QQS 018/020	03/25/92	Lk	31.1	28.2	5.0	7.0	U	304276/811989
QQS 221/222	03/25/92	Lk	38.6	36.5	9.0	8.9	U	304261/812339
QQS 023/024	03/26/92	Cc	58.3	48.8	27.5	12.9	U	304232/811612
QQS 172/173	05/07/92	Cc	67.7	*	37.0	13.0	U	304256/812148
QQS 174/175	05/07/92	Cc	62.4	*	33.6	12.1	U	304272/811831
QQT 274/275	05/07/92	Cc	73.5	*	43.2	14.6	U	304301/812115
N/A	06/15/92	Lk	*	*	21.4	10.5	U	304258/812241
QQT 004/005	06/15/92	Cc	*	*	136.4	24.0	M	304275/812026
QQT 008/009	06/15/92	Cc	66.5	53.0	44.0	13.0	U	304264/812382

(Sheet 3 of 5)

Table C2 (Continued)

Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release LAT/LON
QQT 034/035	07/20/91	Cc	65.5	53.7	43.0	13.7	U	304277/811839
QQT 036/037	07/20/92	Cc	63.2	51.8	42.0	13.0	U	304273/812084
QQT 032/033	07/21/92	Cc	52.9	43.0	23.0	10.8	U	304268/812025
QQT 038/039	07/21/92	Cc	43.4	37.6	15.0	9.7	U	304270/812027
QQT 057/058	08/17/92	Cc	56.2	48.5	27.0	11.8	U	304280/811827
QQT 060/061	08/17/92	Cc	50.3	42.9	21.0	10.9	U	304280/811827
QQT 062/063	08/17/92	Cc	64.8	52.2	48.0	14.3	U	304256/811686
QQT 064/065	08/17/92	Cc	64.5	51.3	38.0	12.9	U	304285/811794
QQT 066/067	08/17/92	Cc	58.0	49.2	27.0	11.3	U	304267/812201
QQT 070/071	08/18/92	Cc	76.5	58.9	47.8	16.5	U	*
QQT 068/069	08/18/92	Cc	71.8	58.4	*	15.3	U	*
QQT 072/073	08/18/92	Cc	64.3	51.0	38.0	13.8	U	304246/811707
QQT 074/075	08/18/92	Cc	60.1	49.4	36.0	12.3	U	304279/812159
QQT 060/061	09/22/91	Cc	50.3	42.9	20.0	10.8	U	304268/812204
QQT 076/077	09/22/92	Cc	61.1	53.5	33.0	12.6	U	304241/811855
QQT 078/079	09/22/92	Cc	92.4	72.0	98.0	19.5	M	304274/812009
QQT 080/081	09/22/92	Cc	62.2	49.1	31.0	12.9	U	304284/811800
QQT 082/083	09/22/92	Lk	58.7	59.0	33.0	12.8	U	304270/812204
QQT 084/085	09/22/92	Cc	59.1	50.0	32.0	11.0	U	304270/812204
QQT 086/087	09/22/92	Cc	66.4	54.9	43.0	14.0	U	304270/812204
QQT 088/089	09/22/92	Cc	80.4	65.2	59.0	19.0	U	*
QQT 092/093	10/20/92	Cc	66.2	54.1	40.0	14.4	U	304277/812386
QQT 094/095	10/20/92	Cc	55.7	47.8	27.0	11.1	U	304277/812386
QQT 096/097	10/20/92	Cc	81.6	62.2	64.8	16.8	U	304277/812386
QQT 098/100	10/20/92	Cc	58.9	47.9	28.0	12.0	U	304245/811701
QQT 101/102	10/20/92	Cc	73.0	54.2	48.0	14.9	U	304270/811820
QQT 104/105	10/20/92	Cc	73.2	58.5	45.0	14.9	U	304247/811667
QQT 106/107	10/21/92	Cc	66.0	64.0	35.0	13.2	U	304247/811658
QQT 108/109	10/21/92	Cc	55.6	45.8	28.0	10.6	U	304247/811658
QQT 110/111	10/21/92	CC	48.3	43.9	16.0	10.5	U	304247/811658
QQT 112/113	10/21/92	Cc	61.8	51.0	33.0	12.6	U	304265/812223

(Sheet 4 of 5)

Table C2 (Concluded)

Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release LAT/LON
QQR 220/221	10/21/92	Cc	60.1	48.6	31.0	12.2	U	304265/812223
QQS 127/128	11/18/92	Cc	56.7	47.2	27.0	12.0	U	304271/812045
QQT 114/115	11/18/92	Cc	62.6	51.2	34.0	13.0	U	304271/812045
QQT 116/117	11/18/92	Cc	55.9	45.5	24.0	12.2	U	304271/812045
QQT 118/119	11/18/92	Cc	57.3	46.0	26.0	13.0	U	304242/811645
QQT 120/121	11/19/92	Cc	59.8	48.7	30.0	13.0	U	304273/812017
QQT 122/123	11/19/92	Cc	66.5	52.8	38.0	12.7	U	304273/812017
QQT124/125	11/19/92	Cc	58.4	46.2	24.0	12.1	U	304280/811961
QQT 126/127	11/19/92	Lk	35.6	33.0	6.0	8.3	U	304265/812180
QQT 128/129	11/19/92	Cc	62.4	51.1	35.0	12.9	U	304265/812180
QQT 130/132	03/29/93	Cc	54.3	49.4	58.0	12.0	U	304246/811692
QQT 133/134	03/30/93	Cc	88.9	65.2	80.0	20.2	F	304274/811989

(Sheet 5 of 5)

Table C3
Summary of Turtles Captured During Monthly Surveys From
Brunswick Harbor Ocean Bar Channel Georgia

Flipper Tag #	Date	SP.	SCL cm.	SCW cm.	WGT kg.	HW cm.	Sex ID	Release LAT/LON
PPT 199/200	5/26/91	Cc	60.0	50.0	33.0	15.0	U	310453/812645
PPT 180/181	5/27/91	Cc	46.0	40.0	15.6	10.0	U	310104/812391
PPT 182/183	5/27/91	Cc	71.1	66.0	49.0	15.0	U	310104/812391
PPT 184/185	5/27/91	Cc	55.5	47.5	30.0	30.0	U	310104/812391
PPT 186/187	5/27/91	Cc	93.0	72.0	170.5	19.0	F	310104/812391
PPT 188/189	5/27/91	Cc	44.4	41.0	15.0	9.6	U	310104/812391
PPT 190/191	5/27/91	Cc	86.0	71.0	100.0	17.3	F	310104/8123/91
PPT 192/193	5/27/91	Cc	55.2	49.5	28.0	11.4	U	310282/812264
PPT 194/195	5/28/91	Cc	44.0	37.5	14.0	9.2	U	310282/812264
PPT 196/197	5/28/91	Cc	57.5	49.2	30.0	11.4	U	310282/812264
PPT 201/202	5/29/91	Cc	60.0	52.0	34.0	13.0	U	310775/813150
PPT 203/204	5/30/91	Cc	64.5	53.0	45.0	13.0	U	310775/813150
PPT 205/206	5/30/91	Cc	59.7	49.5	34.0	12.7	U	310775/813150
PPT 207/208	6/01/91	Cc	54.5	45.0	28.0	11.5	U	310491/811781
PPT 249/250	6/02/91	Cc	92.0	73.5	132.0	19.0	F	310750/812520
PPT 247/248	6/02/91	Cc	70.0	54.5	55.0	14.5	U	310775/812530
PPT 245/246	6/03/91	Cc	56.0	48.5	25.0	11.5	U	310775/810775
PPT 237/238	6/03/91	Cc	64.5	56.0	34.0	13.5	U	310775/813150
PPT 243/244	6/03/91	Cc	53.5	43.5	15.0	11.0	U	310775/813150
PPT 241/242	6/03/91	Cc	55.0	47.5	22.0	11.0	U	310775/813150
PPT 209/210	6/03/91	Cc	66.5	54.5	36.0	12.5	U	310775/813150
PPT 226/227	6/03/91	Cc	48.5	42.5	20.0	10.5	U	310775/813150
PPT 211/212	6/04/91	Cc	55.5	45.5	22.0	11.5	U	310775/813150
PPT 239/240	6/05/91	Cc	47.5	40.5	16.0	10.0	U	310775/813150
PPT 228/229	6/06/91	Cc	59.5	50.5	34.0	11.5	U	310775/813150
PPT 235/236	6/06/91	Cc	95.0	75.5	135.5	20.5	F	310775/813150
PPT 213/214	6/07/91	Cc	57.5	47.0	26.0	11.5	U	310775/813150
PPT 215/216	6/07/91	Cc	54.5	48.0	24.0	11.5	U	310775/813150
PPT 230/231	6/08/91	Cc	86.5	*	95.5	18.0	F	310775/813150
PPT 232/233	6/08/91	Cc	61.0	53.0	37.0	13.0	U	310775/813150

(Sheet 1 of 6)

Table C3 (Continued)

Flipper Tag #	Date	SP.	SCL cm.	SCW cm.	WGT kg.	HW cm.	Sex ID	Release LAT/LON
PPT 219/234	6/09/91	Cc	67.0	53.5	41.0	13.7	U	310775/813150
QQH 721/721	6/09/91	Cc	56.0	45.0	16.0	11.0	U	310775/813150
PPT 217/218	6/09/91	Cc	66.5	53.5	45.0	14.0	U	310775/813150
Not Tagged	6/09/91	Lk	31.0	29.8	4.5	6.8	U	310775/813150
PPT 220/221	6/10/91	Cc	57.5	48.5	30.0	11.0	U	310775/812384
PPT 222/223	6/10/91	Cc	62.5	52.3	41.0	13.0	U	310775/813150
PPT 224/225	6/11/91	Cc	83.5	*	84.0	16.0	M	310775/813150
PPT 129/130	6/11/91	Cc	59.5	50.0	24.0	12.2	U	310775/813150
PPT 127/128	6/11/91	Cc	60.5	50.0	23.0	12.0	U	310775/813150
PPT 133/134	6/11/91	Cc	64.3	*	39.0	13.3	U	310775/813150
PPT 135/136	6/12/91	Cc	53.5	48.5	23.0	11.3	U	310775/813150
PPT 137/138	6/12/91	Cc	56.5	50.5	31.0	11.5	U	310775/803150
PPT 139/140	6/12/91	Cc	>110	>110	148.0	19.1	F	310775/803150
PPT 205/206	6/12/91	Cc	60.3	49.0	34.0	12.5	U	310775/813150
PPT 141/142	6/12/91	Lk	48.5	48.5	17.0	10.3	U	310775/813150
PPT 143/144	6/12/91	Cc	58.5	48.0	28.0	11.5	U	310775/813150
PPT 145/146	6/12/91	Cc	63.0	53.0	36.0	13.1	U	310775/813150
PPT 147/148	6/14/91	Cc	>100	>100	132.0	19.8	M	310775/813150
PPT 149/150	6/14/91	Cc	74.2	*	57.0	15.1	U	310775/813150
QQN 101/102	6/14/91	Cc	54.4	47.0	24.0	10.9	U	310775/813150
QQN 103/104	6/15/91	Cc	61.7	52.2	25.5	12.4	U	Channel buoy 17
QQN 105/106	6/15/91	Cc	58.3	47.0	24.0	12.1	U	310775/812222
QQN 111/112	6/15/91	Cc	43.8	39.2	14.0	10.0	U	310775/813150
QQN 107/108	6/15/91	Cc	58.4	50.2	34.0	12.5	U	310775/813150
QQN 109/110	6/15/91	Cc	68.0	56.7	45.5	13.5	U	Channel Buoy 7
QQN 115/116	6/15/91	Cc	51.5	43.1	22.0	11.0	U	310775/813150
QQN 113/114	6/15/91	Cc	57.0	48.1	27.0	12.0	U	310775/813150
QQN 117/118	6/16/91	Cc	58.3	51.2	33.0	12.7	U	310775/813150
QQN 199/120	6/17/91	Cc	63.6	52.6	41.0	13.2	U	Channel Buoy 9
QQN 121/122	6/17/91	Cc	71.8	*	54.5	14.7	U	310775/813150
QQN 123/124	6/17/91	Cc	58.8	49.0	38.0	13.3	U	310775/813150

(Sheet 2 of 6)

Table C3 (Continued)								
Flipper Tag #	Date	SP.	SCL cm.	SCW cm.	WGT kg.	HW cm.	Sex ID	Release LAT/LON
QQH 726/727	6/18/91	Cc	61.0	52.2	33.0	13.4	U	310775/813150
QQN 149/150	6/18/91	Cc	59.0	50.9	34.0	12.1	U	310775/813150
QQN 147/148	6/18/91	Cc	68.0	53.2	44.0	14.0	U	310775/813150
QQN 145/146	6/18/91	Cc	69.6	*	54.5	14.0	U	310775/813150
QQN 153/154	6/18/91	Cc	41.0	35.5	13.0	9.5	U	310775/813150
QQN 151/152	6/18/92	Cc	62.2	50.3	40.0	13.3	U	310775/813150
QQN 155/156	6/20/91	Cc	61.3	51.0	37.0	12.8	U	310775/813150
QQN 157/158	6/20/91	Cc	63.3	51.2	41.0	13.7	U	St. Simons Sound
QQN 159/160	6/20/91	Cc	61.0	53.5	34.0	12.7	U	St. Simons Sound
QQN 161/162	6/20/91	Cc	52.1	44.5	23.0	11.2	U	St. Simons Sound
QQH 721/721	9/29/91	Cc	57.4	45.9	24.0	11.0	U	310696/812178
QQR 374/375	9/29/91	Cc	67.1	54.4	42.0	13.8	U	310555/811966
QQR 373/372	9/29/91	Cc	51.4	43.7	20.0	11.6	U	310555/811966
QQN 149/150	9/29/91	Cc	60.5	50.9	30.0	11.9	U	310555/801966
QQR 370/371	9/29/91	Cc	61.8	50.8	31.0	12.2	U	310555/811966
QQR 368/369	9/29/91	Cc	54.1	45.6	22.0	10.8	U	310577/811968
QQR 351/353	10/01/91	Cc	67.4	54.2	41.0	14.9	U	310541/811897
QQR 254/355	10/01/91	Cc	51.9	41.9	17.0	10.9	U	310516/811853
QQR 356/357	10/01/91	Cc	93.8	64.8	110.0	20.1	F	310582/811979
QQR 358/359	10/01/91	Lk	38.2	36.9	8.0	8.6	U	GA. DNR
QQR 360/361	10/01/91	Cc	65.7	69.5	41.0	12.8	U	310530/8119/10
QQR 362/363	10/02/91	Cc	59.7	49.3	29.0	12.5	U	310749/812264
QQR 364	10/02/91	Lk	41.8	39.9	11.0	9.6	U	GA DNR
QQR 365/366	10/02/91	Cc	63.7	55.1	35.0	13.2	U	310706/812887
QQR 301/302	10/02/91	Cc	89.4	68.4	103.0	19.7	M	GA DNR
QQR 303/304	10/03/91	Cc	59.2	46.3	26.0	11.7	U	GA DNR
QQR 305/306	10/03/91	Cc	60.9	50.5	35.0	12.5	U	GA DNR
QQR 307/308	10/03/91	Cc	66.7	51.9	39.5	14.6	U	310781/812424
QQR 309/310	10/03/91	Cc	60.5	52.7	34.0	13.6	U	310725/812217
QQR 311/312	10/03/91	Cc	57.8	48.4	29.0	12.3	U	Channel Buoy 3
QQR 313/314	10/03/91	Cc	58.5	46.7	27.0	12.7	U	310619/811919
(Sheet 3 of 6)								

Table C3 (Continued)

Flipper Tag #	Date	SP.	SCL cm.	SCW cm.	WGT kg.	HW cm.	Sex ID	Release LAT/LON
QQR 315/316	10/03/91	Cc	51.3	43.7	21.0	12.1	U	310773/812388
QQR 187/200	10/25/91	Cc	56.9	45.8	27.0	11.6	U	310469/811741
QQR 128/199	10/25/91	Cc	58.5	49.0	31.0	12.2	U	310469/811741
QQR 130/162	10/25/91	Cc	61.0	59.9	30.0	12.7	U	310469/811741
QQR 102/146	10/25/91	Cc	56.5	48.7	29.0	12.5	U	310469/811741
QQR 066/075	10/25/91	Cc	79.8	63.3	73.0	17.4	U	310730/812208
QQR 072/073	10/25/91	Cc	64.6	54.7	40.5	14.1	U	310730/812208
QQR 067/068	10/25/91	Cc	61.9	50.5	34.0	12.9	U	310730/812208
QQR 070/071	10/25/91	Cc	*	49.0	29.0	12.4	U	310730/812208
QQR 069/077	10/25/91	Cc	62.6	51.2	31.0	12.9	U	310730/812208
QQR 078/080	10/25/91	Cc	64.7	54.1	39.0	13.5	U	310730/812208
QQR 093/094	10/25/91	Lk	41.6	40.4	10.0	9.4	U	310764/812306
QQR 081/082	10/25/91	Cc	71.3	58.8	54.0	15.2	U	310764/812306
QQR 083/087	10/25/91	Cc	64.8	51.4	40.0	13.4	U	310764/812306
QQR 084/085	10/26/91	Cc	63.5	53.7	42.0	13.6	U	310764/812306
QQR 086/088	10/26/91	Cc	74.1	55.6	54.0	16.0	U	310764/812306
QQR 089/090	10/26/91	Cc	55.6	48.1	26.0	12.5	U	310764/812306
QQR 091/092	10/26/91	Cc	51.7	45.9	22.5	10.7	U	310764/812306
QQR 095/096	10/27/91	Cc	68.5	54.9	49.0	14.6	U	310557/811957
QQR 097/099	10/27/91	Cc	62.4	49.2	36.0	12.9	U	310739/812225
QQR 100/376	10/27/91	Cc	66.9	54.0	46.0	14.6	U	310739/812225
QQR 076/377	10/27/91	Cc	58.2	49.4	27.0	11.0	U	310447/811802
QQR 074/378	10/27/91	Cc	60.3	48.2	29.0	12.0	U	310447/811802
QQR 379/380	10/27/91	Cc	70.5	55.3	48.0	14.4	U	310791/812368
QQR 385/386	10/27/91	Cc	64.9	49.5	35.0	13.1	U	310791/812368
QQR 387/388	10/27/91	Cc	70.1	56.9	48.0	13.6	U	310791/812368
QQR 381/382	10/27/91	Cc	76.2	62.7	56.0	15.1	U	31079.1/812368
QQR 383/384	10/27/91	Cc	79.1	62.6	100.0	17.6	U	310791/812368
QQR 389/390	10/27/91	Cc	56.2	49.2	27.0	12.2	U	310791/812368
QQR 391/392	10/28/91	Cc	50.6	44.0	20.0	10.9	U	310456/811776
QQR 393/394	10/28/91	Cc	52.2	45.0	22.0	11.4	U	310456/811776

(Sheet 4 of 6)

Table C3 (Continued)								
Flipper Tag #	Date	SP.	SCL cm.	SCW cm.	WGT kg.	HW cm.	Sex ID	Release LAT/LON
QQR 395/396	10/28/91	Cc	57.0	49.2	28.0	12.0	U	310456/811776
QQR 397/398	10/28/91	Cc	58.5	50.5	31.0	12.2	U	310389/811591
QQR 399/400	10/28/91	Cc	57.4	46.2	29.0	12.3	U	310389/811591
Not Tagged	10/28/91	Lk	38.3	34.6	*	8.7	U	GA DNR
QQR 234/235	10/28/91	Cc	63.1	81.6	76.0	16.6	U	310697/812140
QQR 236/238	10/28/91	Cc	62.2	51.3	36.0	13.4	U	310754/812289
QQR 237/239	10/28/91	Cc	73.1	58.0	52.0	14.5	U	310708/812178
QQR 240/241	10/29/91	Cc	63.1	51.8	32.0	12.8	U	310786/812418
QQR 242/243	10/29/91	Cc	61.6	51.2	32.0	12.8	U	310786/812418
QQR 244/245	10/29/91	Cc	73.4	58.9	53.0	14.8	U	310735/812237
QQR 393/394	10/29/91	Cc	52.2	45.0	22.0	11.4	U	310645/812062
QQR 246/247	10/29/91	Cc	56.5	46.5	23.0	11.7	U	310735/812237
QQR 249/250	10/29/91	Cc	44.6	37.9	14.0	9.6	U	310735/812237
QQS 003/004	12/02/91	Lk	42.2	37.9	11.0	9.6	U	310575/811958
QQH 720/721	12/02/91	Cc	57.8	45.7	25.0	12.1	U	310743/812269
QQS 005/006	12/04/91	Lk	40.4	39.7	9.0	9.5	U	310494/811828
QQS 007/008	12/04/91	Cc	52.4	43.6	23.0	11.6	U	310563/811945
QQS 143/144	3/07/92	Cc	60.3	53.5	32.0	13.0	U	310548/811919
QQR 331/332	3/08/92	Cc	61.0	52.6	31.0	11.0	U	310787/812452
QQS 148/149	3/09/92	Cc	57.0	50.2	29.0	11.7	U	3105616/811850
QQN 173/174	3/09/92	Cc	61.1	50.5	36.0	12.5	U	310516/811850
QQS 145/146 QQR 190/191	3/10/92	Cc	61.0	47.8	30.0	12.5	U	310398/811151
QQN 176/177	3/10/92	Cc	91.4	70.2	95.5	20.9	M	310495/811844
QQN 178/179	3/10/92	Cc	55.2	47.9	23.0	12.0	U	310672/812154
QQN 166/167	3/10/92	Cc	58.9	46.8	26.0	12.6	U	310677/812159
QQN 180/181	3/11/92	Cm	46.6	37.5	12.0	7.4	U	310774/812440
QQS 041/043	4/08/92	Cc	73.5	58.0	55.0	14.9	U	310453/811753
QQS 152/153	4/08/92	Cc	47.0	40.0	16.0	10.4	U	310549/811907
QQS 154/155	4/08/92	Cc	68.8	55.7	42.0	14.2	U	310550/811926
QQS 156/157	4/08/92	Cc	53.4	46.0	23.0	12.2	U	310705/812196
QQS 158/159	4/08/92	Cc	90.2	73.0	92.3	18.4	M	310643/812079
(Sheet 5 of 6)								

Table C3 (Concluded)

Flipper Tag #	Date	SP.	SCL cm.	SCW cm.	WGT kg.	HW cm.	Sex ID	Release LAT/LON
QQS 160/161	4/08/92	Cc	56.4	47.4	25.0	11.4	U	310378/811640
QQS 162/163	4/09/92	Cc	54.2	45.9	20.0	12.6	U	310641/812093
QQS 164/165	4/09/92	Lk	34.2	31.4	5.5	7.9	U	310700/812186
QQS 166/167	4/09/92	Cc	62.3	48.4	30.0	12.4	U	310646/812089
QQS 168/169	4/09/92	Cc	63.2	54.5	36.0	13.4	U	310766/812321
QQS 170/171	4/09/92	Cc	68.6	56.6	40.0	14.7	U	310766/812321
(Sheet 6 of 6)								

Table C4
Summary of Turtles Captured During Monthly Surveys From
Savannah Harbor Ocean Bar Channel

Flipper Tag #	Date	SCL (cm)	SCW (cm)	HW (cm)	WGT (kg)	Sex ID	Release Location
QQN 126 QQN 127	06/23/91	59.4	49.1	12.1	31	U	Lazeretto Creek
QQN 128 QQN 129	06/25/91	57.1	48.9	12	29	U	Wilmington River
QQN 130 QQN 131	06/25/91	66.5	52.6	14.8	46	U	Wilmington River
QQN 132 QQN 133	06/26/91	64	NA	13	41	U	Ossabaw Sound
QQN 134 QQN 135	06/26/91	56.5	47.8	11.5	41	U	Ossabaw Sound
QQN 136 QQN 137	06/26/91	54.7	45.1	12.1	11	U	Ossabaw Sound
QQN 138 QQN 139	06/26/91	50.8	45.2	10.6	21	U	Ossabaw Sound
QQN 140 QQN 141	06/26/91	57.7	51.2	11.8	30	U	Ossabaw Sound
QQN 142 QQN 143	06/26/91	93.3	NA	20	109	M	Ossabaw Sound
QQR 001 QQR 002	08/01/91	59.5	48.7	12.8	76	U	Wilmington River
QQR 003 QQR 004	08/01/91	61.5	50.1	13	36	U	Wilmington River
QQR 005 QQR 006	08/04/91	58.5	51	12.4	35	U	Wilmington River
QQR 007 QQR 008	08/04/91	65	55	14	44	U	Wilmington River
QQR 010 QQR 011	08/05/91	59.8	50.3	11.4	31	U	Lazeretto Creek
QQR 012 QQR 013	08/05/91	86.5	NA	16	86	M	Lazeretto Creek
QQR 015 QQR 016	08/06/91	57.2	49.3	11.4	31	U	Lazeretto Creek
QQR 018 QQR 019	08/06/91	56.1	46.9	12	28	U	Lazeretto Creek
QQR 020 QQR 022	08/06/91	71.2	NA	14.3	55	U	Lazeretto Creek
QQR 023 QQR 024	08/07/91	64.5	53.9	13.1	33	U	Lazeretto Creek
QQR 026 QQR 027	08/07/91	65.5	55.2	NA	49	U	Lazeretto Creek
QQR 028 QQR 029	08/08/91	52.3	43	11	24	U	Lazeretto Creek
QQR 030 QQR 031	08/08/91	68.2	NA	13.9	51	U	Lazeretto Creek
QQR 032 QQR 035	08/10/91	64.5	54.7	13.5	44	U	Wilmington River
QQR 037 QQR 038	08/10/91	70.5	57.7	15.2	52	U	Wilmington River
QQR 040 QQR 042	08/12/91	57.5	47.8	11.2	34	U	Wilmington River
QQR 044 QQR 045	08/12/91	66.4	55	12.2	45	U	Wilmington River
QQR 046 QQR 047	08/12/91	55.4	48.1	11.3	31	U	Wilmington River
Not Tagged	08/12/91	NA	NA	NA	NA	U	Georgia DNR
QQR 049 QQR 050	08/12/91	65	49.9	12.1	39	U	Wilmington River

(Sheet 1 of 5)

Note: All loggerheads except one Kemp's ridley QQR 275 QQR 276.

Table C4 (Continued)

Flipper Tag #	Date	SCL (cm)	SCW (cm)	HW (cm)	WGT (kg)	Sex ID	Release Location
QQR 051 QQR 052	08/13/91	53.6	47.6	9.9	25	U	Lazeretto Creek
QQR 053 QQR 054	08/13/91	57.4	48.3	10.9	32	U	Lazeretto Creek
QQR 055 QQR 056	08/14/91	52.5	44.3	10.8	22	U	Ossabaw Sound
QQR 057 QQR 059	08/14/91	64	54.4	14.1	42	U	Ossabaw Sound
QQR 060 QQR 061	08/14/91	58.7	49.7	13.2	32	U	Ossabaw Sound
QQR 062 QQR 063	08/14/91	62.8	52.4	13.6	38	U	Ossabaw Sound
QQR 064 QQR 065	08/14/91	59.9	49.6	12	34	U	Ossabaw Sound
Flipper Tag #	Date	SCL (cm)	SCW (cm)	HW (cm)	WGT (kg)	Sex ID	Release LAT/LON
QQR 154 QQR 153	10/03/91	64.1	52.6	13.2	36	U	320085/804815
QQR 156 QQR 157	10/03/91	62.7	51.4	13.5	36	U	315836/804490
Not Tagged	10/04/91	NA	NA	NA	NA	U	NA
QQN 135 QQN 136	10/04/91	57.7	48.5	11.7	29	U	315952/604728
QQR 138 QQR 136	10/04/91	51.8	42.9	11.1	23	U	315952/604728
QQR 134 QQH 524	10/04/91	68.2	51.6	14.9	45	U	320166/804907
QQR 037 QQR 133	10/04/91	70.5	57.4	14.7	50	U	320190/804952
QQR 110 QQR 111	10/04/91	61.8	50.2	14.5	38	U	NA
QQR 112 QQR 118	10/05/91	62.5	49.6	12.1	36	U	315903/804680
QQR 113 QQR 114	10/05/91	68.3	52.6	12.1	40	U	315903/804680
QQR 115 QQR 116	10/05/91	71.8	54.7	14.9	54	U	315930/804740
QQR 062 QQR 063	10/05/91	63.9	51.9	13.1	34	U	315903/804680
QQR 124 QQR 123	10/05/91	75.2	60.7	16.2	64	U	315908/804660
QQR 119 QQR 120	10/05/91	62.4	48.3	16.4	35	U	320087/844859
QQR 177 QQR 176	10/05/91	74.3	60.5	15.2	61	U	320151/804923
QQR 182 QQR 183	10/05/91	55.4	47.2	11.8	25	U	320103/804856
QQR 121 QQR 122	10/05/91	82.6	64.3	17.2	80	F	320134/804909
QQR 191 QQR 190	10/05/91	60.7	48.1	12.3	32	U	320233/804917
QQR 185 QQR 186	10/06/91	72.6	55.5	14.7	55	U	315857/804519
QQR 042 QQR 117	10/06/91	58.4	49	12.3	30	U	315857/804519
AAS 598 AAS 599	10/06/91	86.5	63.2	18.5	93	F	315966/804617
QQR 195 QQR 198	10/06/91	61.8	50.9	13.4	34	U	320068/804768
QQR 193 QQR 194	10/06/91	50.4	42.6	10.4	17	U	320068/804811
QQR 166 QQR 140	10/07/91	54	46.7	11.2	23	U	315906/804561

(Sheet 2 of 5)

Table C4 (Continued)

Filpper Tag #	Date	SCL (cm)	SCW (cm)	HW (cm)	WGT (kg)	Sex ID	Release LAT/LON
AAS 598 AAS 599	10/07/91	86.5	63.2	NA	93	F	315906/804561
QQR 169 QQR 171	10/07/91	55.8	46.5	12.5	26	U	NA
QQR 172 QQR 173	10/07/91	55	46	12.7	26	U	NA
QQR 178 QQR 184	10/07/91	54.4	45.5	11.4	24	U	NA
QQR 251 QQR 252	10/30/91	50.4	41.8	10.7	23	U	315846/804772
QQR 253 QQR 254	10/30/91	56.4	48.6	11.5	27	U	320159/804777
QQR 134 QQH 524	10/30/91	67.8	52.3	15	48	U	320057/804860
QQR 255 QQR 256	10/30/91	61	47.6	13.4	32	U	320156/804871
QQR 257 QQR 258	10/31/91	57.1	57	11.8	24	U	320153/804849
QQR 259 QQR 260	10/31/91	60.1	49.4	12.4	32	U	320153/804849
QQR 261 QQR 262	10/31/91	56.8	47.9	11	28	U	320222/805020
QQR 263 QQR 264	10/31/91	52.8	43.6	11	22	U	320208/805246
Not Tagged	10/31/91	55.1	55.2	12.5	NA	U	NA
QQR 275 QQR 276*	10/31/91	37.1	35.7	9.1	8.5	U	320173/804876
QQR 265 QQR 266	10/31/91	62.9	51.8	12.6	32	U	315934/804624
QQR 267 QQR 268	10/31/91	66	54.2	14.3	41	U	320208/804994
QQR 269 QQR 270	10/31/91	84.3	64.5	17	72	F	320208/804994
QQR 271 QQR 272	11/01/91	59.3	45.8	12.4	26	U	320027/804994
QQR 273 QQR 274	11/01/91	74.8	60.9	15.4	56	U	320027/804740
QQR 166 QQR 140	11/01/91	54.1	46.3	11.3	23	U	320027/804740
QQR 277 QQR 278	11/01/91	58.9	48.2	13	29	U	315946/804622
QQR 279 QQR 280	11/01/91	60	50.4	12.3	33	U	315946/804622
QQR 282 QQR 281	11/01/91	60.7	49.8	12.8	29	U	320221/805056
QQR 283 QQR 284	11/02/91	69.8	NA	14.6	44	U	315939/804612
QQR 285 QQR 286	11/02/91	57.8	47.5	11.9	25	U	315764/804382
QQR 007 QQR 008	11/02/91	67	55.2	14.8	44	U	315764/804382
QQR 288 QQR 289	11/02/91	86.6	65.5	18.6	92	F	315929/804606
QQR 291 QQR 290	11/02/91	62	51.9	13.2	34	U	320009/804727
QQR 287 QQR 292	11/02/91	49.6	41.9	11.3	17	U	320179/804914
QQR 293 QQR 294	11/02/91	50.4	43.7	10.1	19	U	315868/804490
QQR 295 QQR 296	11/02/91	56.9	46.9	11.8	26	U	315868/804490

(Sheet 3 of 5)

* Kemp's ridley.

Table C4 (Continued)

Flipper Tag #	Date	SCL (cm)	SCW (cm)	HW (cm)	WGT (kg)	Sex ID	Release LAT/LON
QQR 297 QQR 298	11/02/91	60.9	50.4	12.5	34	U	320222/805023
QQR 299 QQR 300	11/03/91	60.2	50.2	12.9	30	U	315858/804451
QQS 002 QQS 001	11/03/91	65.4	51.9	13.9	38.5	U	315878/804499
QQR 026 QQR 027	11/03/91	68.7	57.3	14.8	49	U	315990/804710
QQS 009 QQS 010	12/07/91	61.2	52.7	13.6	34	U	315922/804610
QQS 012 QQS 013	12/10/91	62.7	52.4	13.6	39	U	315821/804398
QQS 014 QQS 015	12/11/91	70.3	54.6	14.4	41	U	315876/804512
QQS 176 QQS 177	04/04/92	69.2	55.3	14.8	42	U	315986/804753
QQS 027 QQS 026	05/01/92	56.8	47.1	12.4	26	U	315918/804613
QQS 038 QQS 035	05/01/92	92.8	73.2	19.2	113	M	320114/804843
QQS 009 QQS 010	05/02/92	61	52.8	13.5	31	U	320109/804834
QQT 263 QQT 262	07/04/92	65.5	53.9	15.1	42	U	315862/804459
QQT 260 QQT 261	07/04/92	50.7	41.7	11.7	20.5	U	315919/804578
QQT 259 QQT 258	07/04/92	58.5	50.5	12.5	33	U	320150/804851
QQT 257 QQT 256	07/04/92	60.7	52.8	12.9	34	U	320149/804849
QQT 259 QQT 258	07/04/92	58.5	50.5	12.5	33	U	320218/804986
QQT 252 QTT 253	07/05/92	92.8	73.2	19.1	101	F	315841/804447
QQT 255 QQT 254	07/05/92	59.7	52.5	12.3	34	U	315838/804414
QQN 199 QQN 198	09/04/92	60.9	53	13.8	35	U	320076/804789
QQN 195 QQN 196	09/04/92	65.9	58.7	14.5	50	U	320226/805078
QQN 193 QQN 194	09/04/92	74.6	60.9	16.3	62.5	U	320226/805078
QQS 179 QQR 028	09/04/92	57.4	47	12	31	U	320235/805016
QQS 187 QQN 188	09/04/92	69	58	15.5	56	U	320235/805016
QQS 181 QQS 180	09/04/92	65.4	53.8	14.4	44	U	320235/805016
QQS 183 QQS 197	09/04/92	61.9	51.5	13.5	35	U	320235/805016
QQS 185 QQS 186	09/05/92	77.9	62.7	15.4	51	U	320196/804930
QQN 187 QQN 192	09/05/92	NA	67.9	18.2	NA	U	320221/805005
QQN 188 QQN 189	09/05/92	90.6	70.7	18.9	97	F	320221/805005
QQT 300 QQN 191	09/05/92	70.6	58	15.2	50	U	320221/805005
QQT 214 QQT 213	10/10/92	62.4	52.7	13.6	37	U	320017/804753
QQT 215 QQT 216	10/11/92	53.2	44.4	11	24	U	320133/804842

(Sheet 4 of 5)

Table C4 (Concluded)							
Flipper Tag #	Date	SCL (cm)	SCW (cm)	HW (cm)	WGT (kg)	Sex ID	Release LAT/LON
QQS 183 QQS 197	10/11/92	60.9	50.8	13.3	33	U	320133/804842
QQT 218 QQT 217	10/11/92	56.7	25.9	12.4	26	U	320201/804900
QQT 219 QQT 220	10/11/92	71.5	58.1	13.6	47	U	315924/804590
QQT 224 QQT 223	10/11/92	57.9	48.3	12.2	25	U	325921/814589
QQT 222 QQT 221	10/11/92	55.2	48.6	12.1	25	U	315921/804589
QQT 234 QQT 233	10/11/92	87.8	63.1	17.5	90	F	315854/804438
QQT 231 QQT 232	10/11/92	59.4	51.2	12.6	32	U	315854/804438
QQT 229 QQT 230	10/11/92	58.7	50.2	12.5	28	U	315854/804438
QQT 228 QQT 227	10/11/92	82.8	65.3	16.4	90	F	315854/804438
QQT 225 QQT 226	10/11/92	59.9	47.7	12.7	31	U	320115/804817
QQT 238 QQT 237	10/11/92	59.1	46.6	12.3	30	U	320222/805078
QQT 239 QQT 240	10/11/92	62.3	49.8	12.6	36	U	320209/805366
QQT 244 QQT 245	11/05/92	67.1	54.7	13.4	44	U	315905/804564
QQT 247 QQT 246	11/05/92	65.5	51.1	14.6	40	U	315905/804564
QQT 248 QQT 249	11/05/92	62.8	51.2	13.3	36	U	315978/804694
QQT 295 QQT 250	11/05/92	61.1	50.6	13	30	U	320180/804073
QQT 248 QQT 249	11/05/92	62.8	51.2	13.3	36	U	320180/804073
QQT 294 QQT 293	11/05/92	NA	52.5	13.8	42	U	320180/804073
QQT 291 QQT 292	11/05/92	NA	53.4	13	37	U	320180/804073
QQT 294 QQT 293	11/05/92	NA	52.5	13.8	42	U	320046/804764
QQT 290 QQT 289	11/05/92	56.1	47.3	12.1	26	U	320253/804982
QQT 288 QQT 287	11/05/92	60.3	52.2	13.5	34	U	320253/804982
QQT 276 QQT 277	11/06/92	64.6	53.6	14.2	39	U	315903/804560
QQT 299 QQT 297	11/28/92	56.8	48.3	12.6	29	U	315693/804508
QQT 298 QQT 296	11/28/92	63.3	51.9	13.6	41	U	315693/804508
QQT 285 QQT 286	11/28/92	64	50.7	13	38	U	315814/804811
QQT 278 QQT 279	11/29/92	50.9	43.4	10.9	23	U	315696/804555
QQT 284 QQT 283	11/29/92	55.1	49	11.7	28	U	315727/804620
QQT 214 QQT 213	11/29/92	62.4	53.4	13.7	40	U	315727/804620
QQN 139 QQN 138	11/29/92	52.7	45.3	11.2	21	U	315727/804620
(Sheet 5 of 5)							

Table C5
Summary of Turtles Captured During Monthly Surveys From the
Charleston Harbor Entrance Channel South Carolina

Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release LAT/LON
PPV 898	09/07/91	Cc	58.4	53.2	34.0	12.3	U	323665/794375
NNK 495/496	09/12/91	Lk	62.0	58.5	32.0	12.7	U	323869/794750
QQR 104/105	09/13/91	Cc	59.9	62.9	27.5	12.3	U	323868/794770
QQR 175/ QQH 571	09/13/91	Cc	89.3	66.9	*	16.8	M	323865/794614
QQR 148/149	09/14/91	Cc	67.5	53.0	42.5	14.0	U	323869/794555
QQR 145/147	09/15/91	Cc	63.8	54.6	39.0	13.5	U	323695/794610
QQR 125/ QQH 508	09/15/91	Cc	55.6	45.8	26.0	11.7	U	323827/794662
QQR 143/144	09/17/91	Cc	87.3	69.9	95.4	16.6	M	323616/794373
QQR 142/ PPV 896	09/24/91	Cc	59.6	53.6	54.0	14.2	U	323900/794607
QQR 127/129	09/27/91	Cc	69.2	53.5	45.4	13.9	U	323937/794753
QQR 131/132	09/28/91	Cc	72.2	56.5	*	15.4	U	323944/794725
QQR 168/170	09/28/91	Cc	63.5	52.8	36.4	13.1	U	323866/794729
QQR 165/167	09/29/91	Cc	70.2	54.1	45.4	14.2	U	323800/794812
QQR 160/163	09/30/91	Cc	75.6	60.7	63.2	15.4	U	323800/794812
QQR 158/159	09/30/91	Cc	76.7	59.8	61.8	15.4	U	323800/794812
QQR 150/152	10/01/91	Cc	61.0	51.5	35.0	13.1	U	323792/794529
QQS 049/050	03/30/92	Cm	48.0	37.3	*	7.7	U	323864/794719
QQS 047/048	03/31/92	Cc	53.5	45.2	23.0	11.0	U	323977/794746
QQS 045/046	04/01/92	Cc	53.1	44.3	25.0	11.2	U	323984/794810
QQR 039/048	04/08/92	Cc	53.6	43.0	*	11.0	U	324024/794851
QQS 037/039	04/29/92	Cc	49.6	43.0	18.0	11.0	U	324042/794449
QQS 034/036	04/29/92	Cc	65.5	54.7	40.0	13.2	U	324247/794660
QQS 030/031	04/29/92	Cc	59.9	50.7	32.0	12.0	U	324550/795157
QQS 032/033	04/29/92	Cc	68.5	56.6	47.0	14.3	U	324550/795157
QQS 028/029	04/30/92	Cc	53.9	47.5	25.0	11.5	U	324045/794197
QQT 272/273	06/13/92	Cc	51.4	44.8	20.0	10.9	U	324065/794323
QQT 270/271	06/13/92	Cc	72.8	57.1	52.0	15.1	U	324291/794771
QQT 272/273	06/13/92	Cc	51.4	44.8	20.0	10.9	U	324028/794237
(Continued)								

Table C5 (Concluded)								
Flipper Tag #	Date	SP.	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release LAT/LON
QQT 268/269	06/13/92	Cc	56.1	48.0	27.0	11.6	U	324234/794651
QQT 266/267	06/14/92	Cc	112.	85.5	159.0	24.1	M	324239/794605
QQT 264/265	06/14/92	Cc	92.5	70.5	100.0	19.8	M	324084/794334
QQT 251/ QQN 182	07/08/92	Cc	51.3	43.3	19.5	11.2	U	324074/794320
QQS 199/200	07/08/92	Cc	62.1	53.0	40.0	13.6	U	324261/794678
QQS 192/193	07/08/92	Cc	62.9	52.5	*	13.2	U	324178/794506
QQS 191/196	07/08/92	Cc	59.3	49.3	31.0	13.1	U	324028/794224
QQS 188/189	07/08/92	Cc	62.2	50.6	36.5	13.2	U	324028/794224
QQN 183/185	10/08/92	Cc	57.0	47.8	27.0	12.4	U	324546/795150
QQT 201/202	10/08/92	Cc	67.3	56.3	41.0	13.6	U	324546/795153
QQT 203/204	10/08/92	Cc	66.8	58.2	43.0	13.7	U	324235/794735
QQT 205	10/09/92	Cc	70.3	56.2	45.0	14.1	U	324223/797654
QQT 206/207	10/09/92	Cc	61.2	50.4	32.0	11.9	U	324224/794651
QQS 156/157	10/09/92	Cc	57.0	46.4	26.0	12.4	U	324211/794633
QQT 208/209	10/09/92	Cc	52.2	40.4	22.0	10.8	U	324211/794633
QQT 211/212	10/09/92	Cc	54.2	46.0	25.0	11.3	U	324084/794321
QQT 242/243	11/02/92	Cc	73.0	58.9	58.0	15.5	U	324551/795155
QQT 241/210	11/02/92	Cc	67.0	57.2	47.0	14.3	U	324551/795154
QQT 326/327	11/30/92	Cc	57.1	50.8	33.0	12.2	U	324545/795143

Table C6**Summary of Turtles Captured During Monthly Surveys From
Morehead City Harbor Entrance Channel North Carolina (All
Loggerheads)**

Flipper Tag #	Date	SCL (cm)	SCW (cm)	WGT (kg)	HW (cm)	Sex ID	Release LAT/LON
QQN 164/165	12/06/91	48.9	41.6	17.0	10.3	U	343820/763963
QQT 451/452	07/31/91	70.1	57.0	36.4	14.7	U	343914/763939
QQT 476/477	10/12/92	67.5	53.0	*	14.5	U	343927/764050

Table C7
Listing of Captured Turtles With Implanted Passive Integrated
Transponder (PIT) Tags

Flipper Tag #	Pit Tag Number	Species	Capture Location	Date	SCL (cm)
QQT 004/QQT 005	00-0010-63ED	Cc	Fernandina	6/15/92	101.5
N/A	00-0013-BD96	Lk	Fernandina	6/15/92	N/A
QQT 008/QQT 009	00-0013-BF42	Cc	Fernandina	6/16/92	66.5
QQT 011/QQT 016	00-0011-337C	Cc	Fernandina	7/21/92	64.7
QQT 034/QQT 035	00-001A-1E2B	Cc	Fernandina	7/20/92	65.5
QQT 036/QQT 037	00-001A-1B7B	Cc	Fernandina	7/20/92	63.2
QQT 038/QQT 039	00-001A-0E1C	Cc	Fernandina	7/20/92	43.4
QQT 032/QQT 033	00-001A-1621	Cc	Fernandina	7/21/92	52.9
QQT 057/QQT 058	00-0011-E142	Cc	Fernandina	8/17/92	56.2
QQT 060/QQT 061	00-001A-114C	Cc	Fernandina	8/17/92	50.3
QQT 062/QQT 063	00-0022-D925	Cc	Fernandina	8/17/92	64.8
QQT 064/QQT 065	00-0013-C806	Cc	Fernandina	8/17/92	64.5
QQT 066/QQT 067	00-0011-3889	Cc	Fernandina	8/17/92	58.0
QQT 070/QQT 071	00-0012-E6B4	Cc	Fernandina	8/18/92	76.5
QQT 072/QQT 073	00-0011-E56E	Cc	Fernandina	8/18/92	64.3
QQT 074/QQT 075	00-001E-49A8	Cc	Fernandina	8/18/92	60.1
QQT 076/QQT 077	00-0010-78E6	Cc	Fernandina	9/22/92	61.1
QQT 078/QQT 079	00-0011-D04B	Cc	Fernandina	9/22/92	92.4
QQT 080/QQT 081	00-0013-C65F	Cc	Fernandina	9/22/92	62.2
QQT 082/QQT 083	00-0013-C27B	Cc	Fernandina	9/22/92	58.7
QQT 084/QQT 085	00-0010-6EA1	Cc	Fernandina	9/25/92	59.1
QQT 086/QQT 087	00-0010-6D77	Cc	Fernandina	9/22/92	66.4
QQT 088/QQT 089	00-0010-787C	Cc	Fernandina	9/22/92	80.4
QQT 092/QQT 093	00-0013-C155	Cc	Fernandina	10/20/92	66.2
QQT 094/QQT 095	00-0013-C607	Cc	Fernandina	10/20/92	55.7
QQT 096/QQT 097	00-0013-B959	Cc	Fernandina	10/20/92	81.6
QQT 098/QQT 100	00-0013-BAA2	Cc	Fernandina	10/20/92	58.9
QQT 101/QQT 102	00-0010-63CF	Cc	Fernandina	10/20/92	73.0
QQT 104/QQT 105	00-0010-6ED8	Cc	Fernandina	10/20/92	73.2
QQT 106/QQT 107	00-0010-746C	Cc	Fernandina	10/21/92	66.0

(Sheet 1 of 3)

Table C7 (Continued)

Flipper Tag #	Pit Tag Number	Species	Capture Location	Date	SCL (cm)
QQT 108/QQT 109	00-0013-C2FD	Cc	Fernandina	10/21/92	55.6
QQT 110/QQT 111	00-0010-79E1	Cc	Fernandina	10/21/92	48.3
QQT 112/QQT 113	00-0013-C542	Cc	Fernandina	10/21/92	61.8
QQR 220/QQR 221	00-0013-BCB9	Cc	Fernandina	10/21/92	60.1
QQS 127/QQS 128	00-0010-6DA0	Cc	Fernandina	11/18/92	56.7
QQT 114/QQT 115	00-0013-B6F8	Cc	Fernandina	11/18/92	62.6
QQT 116/QQT 117	00-0010-6EDC	Cc	Fernandina	11/18/92	55.9
QQT 118/QQT 119	00-0013-CB44	Cc	Fernandina	11/18/92	57.3
QQT 120/QQT 121	00-0010-71FB	Cc	Fernandina	11/19/92	59.8
QQT 122/QQT 123	00-0011-3CB0	Cc	Fernandina	11/19/92	66.5
QQT 124/QQT 125	00-0010-79DD	Cc	Fernandina	11/19/92	58.4
QQT 126/QQT 127	00-0013-C39E	Lk	Fernandina	11/19/92	35.6
QQT 128/QQT 129	00-0010-7214	Cc	Fernandina	11/19/92	62.4
QQT 130/QQT 132	00-0010-676P	Cc	Fernandina	3/29/93	54.3
QQT 133/QQT 134	00-0010-74B3	Cc	Fernandina	3/30/93	88.9
QQT 139/QQT 140	00-0010-7064	Cc	Fernandina	4/09/93	56.8
QQT 141/QQT 142	00-0013-BA57	Cc	Fernandina	4/10/93	56.5
QQT 143/QQT 144	00-0010-6730	Cc	Fernandina	4/16/93	57.7
QQT 145/QQT 146	00-0013-B775	Cc	Fernandina	4/17/93	62.9
QQT 147/QQT 148	00-0011-DD04	Cc	Fernandina	4/17/93	67.8
QQT 149/QQT 150	00-0010-64F1	Cc	Fernandina	4/17/93	94.5
QQT 213/QQT 214	00-0010-7ACA	Cc	Savannah	10/10/92	62.4
QQT 215/QQT 216	00-0013-C7CB	Cc	Savannah	10/11/92	53.2
QQS 183/QQS 197	00-0010-71E8	Cc	Savannah	10/11/92	60.9
QQT 217/QQT 218	00-0013-CAF1	Cc	Savannah	10/11/92	56.7
QQT 219/QQT 220	00-0013-C227	Cc	Savannah	10/11/92	71.5
QQT 221/QQT 222	00-0010-779B	Cc	Savannah	10/11/92	55.2
QQT 223/QQT 224	00-0010-6D3C	Cc	Savannah	10/11/92	57.9
QQT 231/QQT 232	00-0013-BD08	Cc	Savannah	10/11/92	59.4
QQT 233/QQT 234	00-0013-C644	Cc	Savannah	10/11/92	87.8
QQT 225/QQT 226	00-0010-7A64	Cc	Savannah	10/11/92	59.9

(Sheet 2 of 3)

Table C7 (Concluded)

Flipper Tag #	Pit Tag Number	Species	Capture Location	Date	SCL (cm)
QQT 227/QQT 228	00-0010-7396	Cc	Savannah	10/11/92	82.8
QQT 229/QQT 230	00-0013-C5CF	Cc	Savannah	10/11/92	58.7
QQT 237/QQT 238	00-0010-6F92	Cc	Savannah	10/11/92	59.1
QQT 239/QQT 240	00-0010-6ED4	Cc	Savannah	10/11/92	62.3
QQT 244/QQT 245	00-0010-688F	Cc	Savannah	11/05/92	67.1
QQT 246/QQT 247	00-0010-6390	Cc	Savannah	11/05/92	65.5
QQT 248/QQT 249	00-0010-7A0F	Cc	Savannah	11/05/92	62.8
QQT 250/QQT 295	00-0013-BB0C	Cc	Savannah	11/05/92	61.1
QQT 287/QQT 288	00-0010-6890	Cc	Savannah	11/05/92	60.3
QQT 289/QQT 290	00-0010-71BC	Cc	Savannah	11/05/92	56.1
QQT 291/QQT 292	00-0010-7705	Cc	Savannah	11/05/92	61.2
QQT 293/QQT 294	00-0010-7637	Cc	Savannah	11/05/92	60.3
QQT 276/QQT 277	00-0013-BC37	Cc	Savannah	11/06/92	64.6
QQN 183/QQN 185	00-0013-CB02	Cc	Charleston	10/08/92	57.0
QQT 201/QQT 202	00-0010-75AF	Cc	Charleston	10/08/92	67.3
QQT 203/QQT 204	00-0010-67B8	Cc	Charleston	10/08/92	66.8
QQT 205	00-0010-6D46	Cc	Charleston	10/09/92	70.3
QQT 206/QQT 207	00-0013-BD0B	Cc	Charleston	10/09/92	61.2
QQS 156/QQS 157	00-0013-B94E	Cc	Charleston	10/09/92	57.0
QQT 208/QQT 209	00-0013-C441	Cc	Charleston	10/09/92	52.2
QQT 211/QQT 212	00-0010-6FF7	Cc	Charleston	10/09/92	54.2
QQT 242/QQT 243	00-0013-B9F1	Cc	Charleston	11/02/92	73.0
QQT 210/QQT 241	00-0010-7AE4	Cc	Charleston	11/02/92	67.0
QQT 135/QQT 136	00-0013-C30E	Cc	Brunswick	4/03/93	66.0
QQT 137/QQT 138	00-0010-64F9	Cc	Brunswick	4/05/93	63.5
(Sheet 3 of 3)					

Appendix D Summary of Sea Turtle Recaptures

Table D1
Listing of Recaptured Turtles (All Loggerheads) From Canaveral
Harbor Entrance Channel, Florida¹

Month	Tag Number	Date Tagged/ Last Capture	Location Tagged/ Last Capture	Date of Recapture Port Canaveral	Number of Days at Large	Straight Carapace Length (cm)
Apr 92	QQC 682 X 2566/2567	7/17/91	Canaveral ¹	4/15/92	272	85.2
Apr 92	PPY 521 X2568/2569	1/17/90	Kennedy Space, FL	4/15/92	819	67.9
Apr 92	PPY 542/543 BBC 618	Unknown	Unknown	4/16/92	Unknown	61.4
May 92	X 2542/2543	4/13/92	Canaveral	5/12/92	29	108.7
May 92	X 2582/2583	4/16/92	Canaveral	5/14/92	28	104.3
May 92	X 2550/2551	4/13/92	Canaveral	5/14/92	31	99.1
Jun 92	QQH 886/867	Unknown	Unknown	6/17/92	Unknown	75.6
Jun 92	QQM 495/496	Unknown	Unknown	6/17/92	Unknown	81.6
Jun 92	QQH 948/949 X 2694	Unknown	Unknown	6/19/92	Unknown	71.1
Jul 92	X 2701/2702 PPS 834/835	11/9/88	Canaveral*	7/8/92	1,337	72.1
Jul 92	X 2612/2612	5/13/92	Canaveral	7/9/92	57	98.1
Jul 92	X 2709/2710 X 3087/3088	Unknown	Unknown	7/9/92	Unknown	91.8
Jul 92	X 2711/2712 X 4050	Unknown	Unknown	7/9/92	Unknown	91.1
Oct 92	QQC 369/370 X 1082	Unknown	Unknown	10/13/92	Unknown	74.1
Oct 92	X 1089 PPW 304	2/3/89	St. Lucie FL	10/14/92	1,287	61.3
Nov 92	Unknown	Unknown	11/13/92	Unknown	Unknown	60.0
Nov 92	X 1714/1715 X 940	Unknown	Unknown	11/15/92	Unknown	67.9
Nov 92	X 1716 QQE 877	Unknown	Unknown	11/15/92	Unknown	57.5
Jan 93	QQT 066/067	8/17/92	Fernandina FL	1/23/93	159	57.9
Jan 93	X 2577/2576	4/15/92	Canaveral	1/23/93	283	63.0
Jan 93	X 2584/2585	4/16/92	Canaveral	1/24/93	283	63.4
Jan 93	BBA 829 QQC 641 X 1752	Unknown	Unknown	1/24/93	Unknown	62.2
Jan 93	QQM 499/500 X 1754	Unknown	Unknown	1/24/93	Unknown	57.2

¹ Original capture location was in Canaveral; however, not originally captured as part of this study.

Table D2**Listing of Recaptured Turtles From Fernandina Harbor St. Marys River Entrance Channel, Florida (All recaptures were loggerheads)**

Month	Tag Number	Date Tagged/ Last Capture	Location Tagged/ Last Capture	Date of Recapture Fernandina	Number of Days at Large	Straight Carapace Length (cm)
Oct 91	QQR 317 QQR 318	10/08/91	Fernandina	10/09/91	< 1	66.7
Oct 91	QQR 331 QQR 332	10/09/91	Fernandina	10/10/91	< 1	60.5
Dec 91	QQR 333 QQR 334	10/09/91	Fernandina	12/12/91	64	52.2
Dec 91	PPT 150 QQS 135	6/14/90	Brunswick	12/18/91	552	75.2
Dec 91	QQH 791 QQS 136	Unknown	Unknown	12/18/91	Unknown	56.8
Dec 91	QQM 331 QQM 332	6/30/91	Bald Head Is. N.C.	12/18/91	171	98.0
July 92	QQT 032 QQT 033	7/01/92	Fernandina	7/21/92	20	52.9
Sept 92	QQT 060 QQT 061	8/17/92	Fernandina	9/22/92	36	50.3
Oct 92	QQR 220 QQR 221	10/10/91	Fernandina	10/21/92	376	60.1
Nov 92	QQS 127 QQS 128	12/16/91	Fernandina	11/18/92	337	56.7

Table D3
Listing of Recaptured Turtles From Brunswick Harbor Ocean
Bar Channel, Georgia (All recaptures were loggerheads)

Month	Tag Number	Date Tagged/ Last Capture	Location Tagged/ Last Capture	Date of Recapture Brunswick	Number of Days at Large	Straight Carapace Length (cm)
Jun 91	QQH 726 QQH 727	Unknown	Unknown	06/18/91	Unknown	61.0
Jun 91	PPT 205 PPT 206	06/12/91	Brunswick	06/12/91	<1	59.7
Sep 91	QQH 721 QQH 721	06/09/91	Brunswick	09/29/91	113	57.4
Sep 91	QQN 149 QQN 150	06/18/91	Brunswick	09/29/91	104	60.5
Oct 91	QQR 393 QQR 394	10/28/91	Brunswick	10/29/91	1	52.2
Dec 91	QQH 721 QQH 721	09/29/91	Brunswick	12/02/91	65	57.8
Mar 92	QQR 331 QQR 332	10/09/91	Fernandina, FL	03/08/92	151	61.0
Mar 92	QQR 190 QQR 191	10/05/91	Savannah, GA	03/10/92	157	61.0

Table D4
Listing of Recaptured Turtles From Savannah Harbor Ocean Bar
Channel, Georgia (All recaptures were loggerheads)

Month	Tag Number	Date Tagged/ Last Capture	Location Tagged/ Last Capture	Date of Recapture Savannah	Number of Days at Large	Straight Carapace Length (cm)
Oct 91	QQH 524 QQR 134	Unknown	Unknown	10/01/91	Unknown	68.0
Oct 91	QQN 134 QQN 135	06/23/91	Savannah	10/01/91	105	57.7
Oct 91	QQR 037 QQR 038	08/10/91	Savannah	10/04/91	56	70.5
Oct 91	QQR 062 QQR 063	08/14/91	Savannah	10/04/91	52	63.9
Oct 91	AAS 598 AAS 599	Unknown	Unknown	10/07/91	Unknown	86.5
Nov 91	QQH 524 QQR 134	10/04/91	Savannah	11/02/91	91	67.0
Nov 91	QQR 007 QQR 008	08/04/91	Savannah	11/02/91	91	67.0
Nov 91	QQR 026 QQR 027	08/07/91	Savannah	11/03/91	89	68.7
Nov 91	QQR 140 QQR 166	10/07/91	Savannah	11/01/91	26	54.1
Apr 92	QQM 804	08/08/91	Southold Bay, NY	04/04/92	239	51.6
May 92	QQS 009 QQS 010	12/07/91	Savannah	05/02/92	147	61.0
Jul 92	QQT 258 QQT 259	07/04/92	Savannah	07/04/92	< 1	58.5
Sep 92	QQR 028 QQS 178 QQS 179	08/08/91	Savannah	09/04/92	369	57.4
Oct 92	QQS 183 QQS 197	09/04/92	Savannah	10/11/92	38	60.9
Nov 92	QQT 248 QQT 249	11/05/92	Savannah	11/05/92	< 1	67.1
Nov 92	QQT 293 QQT 294	11/05/92	Savannah	11/05/92	< 1	N/A
Dec 92	QQN 138 QQN 139	06/26/91	Savannah	11/29/92	521	52.7
Dec 92	QQT 213 QQT 214	10/10/92	Savannah	11/29/92	51	62.4

Table D5
Listing of Recaptured Turtles From Charleston Harbor Entrance
Channel, South Carolina (All recaptures were loggerheads)

Month	Tag Number	Date Tagged/ Last Capture	Location Tagged/ Last Capture	Date of Recapture Charleston	Number of Days at Large	Straight Carapace Length (cm)
Sept 91	NNK 495 NNK 496	Unknown	Unknown	9/7/91	Unknown	62.0
Sept 91	PPV 898	9/19/90 6/10/91	Charleston Charleston	9/7/91	323 59	58.4
Sept 91	PPV 896 QQR 142	9/19/91 5/14/91	Charleston Charleston	9/7/91	353 116	59.6
Sept 91	QQH 571 QQR 125	Unknown	Unknown	9/13/91	Unknown	89.3
Sept 91	QQH 508 QQR 175	Unknown	Unknown	9/13/91	Unknown	89.3
Apr 92	QQS 156 QQS 157	4/8/92	Brunswick	10/9/92	184	57.0
Jun 92	QQH 583 QQT 270	Unknown	Unknown	6/13/92	Unknown	72.8
Jun 92	QQT 272 QQT 273	6/13/92	Charleston	6/13/92	< 1	51.4

REPORT DOCUMENTATION PAGEForm Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1.AGENCY USE ONLY (Leave blank)		2.REPORT DATE September 1995	3.REPORT TYPE AND DATES COVERED Final report
4.TITLE AND SUBTITLE Assessment of Sea Turtle Abundance in Six South Atlantic U.S. Channels			5.FUNDING NUMBERS
6.AUTHOR(S) Dena D. Dickerson, Kevin J. Reine, David A. Nelson, Charles E. Dickerson, Jr.			
7.PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Engineer Waterways Experiment Station 3909 Halls Ferry Road Vicksburg, MS 39180-6199			8.PERFORMING ORGANIZATION REPORT NUMBER Miscellaneous Paper EL-95-5
9.SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Engineer Division, South Atlantic Room 313, 77 Forsyth Street, SW, Atlanta, GA 30355-6801 U.S. Naval Submarine Base Kings Bay, GA 31558			10.SPONSORING/MONITORING AGENCY REPORT NUMBER
11.SUPPLEMENTARY NOTES Available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.			
12a.DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b.DISTRIBUTION CODE
13.ABSTRACT (Maximum 200 words) <p>Many channels along the southeastern United States coast are inhabited for at least part of the year by sea turtles. Five species of sea turtles occurring in these channels are classified as either federally threatened or endangered. All are potentially affected by hopper dredging activities. Mortalities due to entrainment during hopper dredging operations have been documented for loggerhead (<i>Caretta caretta</i>), green (<i>Chelonia mydas</i>), and Kemp's ridley (<i>Lepidochelys kempi</i>) sea turtles since 1980. Dredging-related sea turtle mortalities have been dramatically reduced as a result of modifications in monitoring protocol, operational procedures, and management practices. However, to develop long-term management plans and conservation strategies, more complete life history and behavioral information is needed. Trawling survey methods were used to provide information on the spatial and temporal abundances of sea turtles in six South Atlantic channels. The channels surveyed included: Canaveral Harbor entrance channel, Florida; Fernandina Harbor St. Marys River entrance channel (Kings Bay), Florida; Brunswick Harbor ocean bar channel, Georgia; Savannah Harbor ocean bar channel, Georgia; Charleston Harbor entrance channel, South Carolina; and Morehead City Harbor entrance channel, North Carolina. The primary objective was to survey the channels for sea turtle relative abundance and determine periods of time when turtles are absent or least abundant. This would help establish valid time periods for protective restrictions on hopper dredging to minimize or eliminate sea turtle mortalities due to dredging activities.</p>			
14.SUBJECT TERMS See reverse.			15.NUMBER OF PAGES 134
			16.PRICE CODE
17.SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18.SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19.SECURITY CLASSIFICATION OF ABSTRACT	20.LIMITATION OF ABSTRACT

14. (Concluded).

Atlantic
Dredging
Florida
Georgia
Green sea turtle
Kemp's ridley
Loggerhead
North Carolina

Recapture
Relative abundance
Relocation
Sea turtle
Ship channel
South Carolina
Trawling